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THE PROMISED LAND.

See Note 1.

THE WORLD'S OPPORTUNITIES

AND

HOW TO USE THEM

By ALFRED H. GUERNSEY, Ph.D.

A VIEW OF THE INDUSTRIAL PROGRESS OF OUR COUNTRY, A CONSIDERATION OF ITS FUTURE DEVELOPMENT, A STUDY OF THE SPHERES OF WOMAN'S WORK, AND ESTIMATES OF THE REWARDS WHICH ART AND SCIENCE, INVENTION AND DISCOVERY, HAVE IN STORE FOR HUMAN ENDEAVOR, WITH AN ANALYSIS OF THE CONDITIONS OF PRESENT AND PROSPECTIVE PROSPERITY

WITH COMPREHENSIVE TABLES OF STATISTICS

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THE WORLD'S OPPORTUNITIES.

CHAPTER I.

THE AIM AND PURPOSE OF THIS BOOK.

ALL men wish for success in life; and most men endeavor, with more or less energy and perseverance, to attain it. The universal desire to better one's condition is a natural and laudable one. The petition for "a mind always contented with our present condition" is one which few persons can offer without much mental reservation. Morbid discontent and querulous repining at our lot in life is indeed to be deprecated. But the invalid may rightly pray for health, and is culpable if he fails to do all he can to gain it. The hungry man rightly prays for food, the naked for clothing, the poor man for competence, the ignorant for instruction; and that for or against which a man may and should pray, is that for or against which he may and should endeavor by all honest and honorable means.

Success in life, as we all understand it, implies not merely freedom from absolute want and privation, but the possession of comforts and conveniences. All men can sincerely join in one part of the prayer of Agur, the son of Jakeh: "Give me not poverty;" but few men, we fancy, sincerely join in the other part: "Neither give me riches." For all men feel that poverty is in itself an evil. There have, indeed, been great and noble men whose lives were passed in poverty, just as there have been such men whose lives were passed in pain and sickness; but they were great and noble in spite of their poverty and sickness —not in consequence of them. Far wiser, in our judgment, is that other passage in this same Hebrew Book of Proverbs which exhorts men to get wisdom, because that, among other reasons, "Length of days is in her right hand, and in her left hand riches and honor." Wealth is a good thing—a thing to be desired and striven for. A man may, indeed, strive for it by dishonest and dishonorable means, and then its acquisition is a bane and a disgrace to him; he may misuse it, just as he may misuse health or strength, learning or genius. In either case the evil is not in the acquisition or the possession, but in the misuse, or, which is essentially the same thing, the failure to make a good use of a thing good in itself.

Wherever a change in one's condition is desirable it is right to effect a change. It is right, if a man's position is a bad one, that he should seek for a good one; if it is a good one, that he should seek for a better. The right position for a man to occupy is the best one to which he can honestly and honorably attain by the best exercise of all his powers and the best use of all his opportunities.

Many foolish things are dinned into our ears by men who should know better. None of these are more foolish than the perpetual lamentations over the "materialistic tendencies" of the age, and more especially of the American people—of their persistent desire and effort to acquire wealth. We hold that when the Creator gave us such abundant means of becoming rich it was that we should become so, and that we are culpable if we do not endeavor to become so, and unwise if we do not succeed. Unless one of the wisest men who ever lived was greatly in error, there is no incompatibility between the strictest care for our material interests and the highest spiritual life. He exhorts us to be "in diligence not slothful" no less earnestly than to be "fervent in spirit," since in both alike we shall be "serving the Lord." This same great man, who has been styled "the Apostle of Faith," ranks what naturally results from carelessness in this respect as an evidence of the gravest demerit. To his most confidential friend he writes: "If any provideth not for his own, and especially his own household, he hath denied the faith, and is worse than an unbeliever." Without this worldly carefulness one cannot provide for his household; and unless he shows his faith by this kind of works, he is worse than if he had no faith at all; and certainly it is no more a man's duty to provide for his household than for himself.

In fact, a man's merit is to a very great degree rightly estimated by his success. It is the reverse of a compliment to a man to call him idle, improvident, negligent, careless, or shiftless; it is not a compliment to call him poor. Many persons talk as though they considered it to be a kind of misdemeanor for any other man to be rich, or, at all events to be much richer than his neighbors. But if one will look a little into the matter he will be pretty sure to find that the censor really means to inveigh only against those who are notably richer than he is. His conscience is not at all disturbed if he finds himself richer than somebody else; the real grievance with such a man is that anybody should be richer than he himself is. Ask him to draw the line where the possession of wealth becomes wrong, and you may be perfectly sure that it will not be below his own position, whatever that may be.

In truth, no man really believes any such thing; and no wise or considerate man acts or talks as though he believed it. Of course, if a man, for any reason, cannot get money honestly, it is better for him not to get it at all. If the choice lies between roguery and poverty, then poverty is to be chosen. It is better to wear a patched coat than to steal a whole one; it may be better even to endure hunger than to appropriate a loaf of bread. But no man of ordinary sense and principle urges his son to refrain from earning wealth, and accumulating his earnings, at least up to a certain amount, which usually is left altogether undefined. If a father ever urges his son to work and save until he has accumulated a certain sum, and then to stop, it is pretty sure that the limit will be quite beyond that which he supposes the boy will ever reach. It is utter folly to attempt to draw the line beyond which any individual man cannot honestly earn money—to say that he may accumulate one thousand dollars, or ten thousand, or a hundred thousand, or any other sum, and must then go out of business, whatever his business may be. One of the ablest of our preachers once replied to a parishioner who said that he meant to retire while in the prime of life: "You have no more right to do so than I have to give up my work of preaching while I am able to perform it." We should accept this only with many reservations. When a man has acquired enough to "provide for his own household," he may, if he pleases, retire from hard work—he has accomplished the task imposed upon him in this respect. There is, however, little danger from this side. It is not the purpose of this volume to point out what a man should do after he has attained success in life, but to indicate some of the paths by which he may hope to reach that success.

No man can reasonably hope to attain that success of which we are speaking unless he shall avail himself of the opportunities which lie before him, or which he may bring within his reach. These opportunities consist, in the first place, of the capacities and talents with which he may be endowed; and these are capable of quite indefinite improvement. A man is, so to speak, himself the implement with which he is to work. Hand and brain, eye and ear, should be trained to the utmost extent of their capabilities for the work which they have to do. A man must, before all things, endeavor to make the most of *himself*. No man, we suppose, ever did this to the utmost possible extent. The most successful man will feel that he has only partially succeeded in his self-education. If he has not done many things which he ought not to have done, he has certainly left undone many things which he ought to have done. No man, perhaps, makes the most of himself; but no one who does not make much of himself will ever make much of anything else.

A man's opportunities also lie greatly in the circumstances and conditions by which he is surrounded. It rests upon him to accommodate himself to these by fitting himself to them or them to himself. No man can do all things; but many men can do more than one thing. If a man cannot find the work which he would best like to do, he must learn to like the best which he can find to do; and in the mean while be on the alert for something better. Good opportunities sometimes come to one without his seeking them; oftener they will not be found unsought. When a promising opportunity presents itself or is found, seize upon it. More men fail of reaching success from hesitancy than from rashness, and more still from lack of fitness for making good use of the opportunity when it does occur. An opportunity once lost is lost forever. Another may, indeed, come or be found; but the mill never grinds again with water which is past.

The aim of this book is a purely practical one. It is purposed to take a comprehensive survey of the principal industries and avocations which are or may be carried on in this country, with a view to ascertain and set forth the opportunities which they severally present for the attainment of success in life. The field to be surveyed is a wide one, embracing not only general principles, but minute details. There can be no trustworthy forecast for the future without a careful survey of the present and a comparison with the past. To judge whether any avocation in life is likely to prove a desirable one, it is essential to ascertain all the facts bearing upon the case: how many persons are now engaged in it, and whether the number is greater or less, in proportion to the whole population, than formerly; what are the respective rates of remuneration, and whether they are stationary, increasing, or diminishing; whether the products themselves will be in future demand, and whether there is likely to be any change in the methods by which they are produced; what improvements may be made either in the products themselves or in their modes of production. These, and numerous other conditions and circumstances, enter into the investigation.

Such an inquiry must be based upon actual and ascertained facts. Statistics, or the collecting and grouping together of facts, are the only reliable bases for speculation and theory. These facts must be gathered from many sources. The personal experience of no one man is wide enough to inform him as to all which he needs to know upon any subject. He must supplement and correct the results of his own observation by that of others. The merchant must study the statistics of all the markets with which he has even indirectly to do. The manufacturer must learn from dry figures what quantity of his wares are likely to be wanted, and whether the markets anywhere are fairly supplied, overstocked, or understocked. The study of statistical tables may appear a dry one, but it is more or less essential in every avocation. A single table of figures, like those contained in a page of this volume, often contains a mass of valuable information to collect and arrange which has cost the labor of many men for many days, weeks, or months. They involve, indeed, an amount of labor and a consequent expense quite beyond the resources of individuals, and only to be executed by the Government, through the agency of the Census Bureau. The entire appropriation for taking the census of 1880 was almost four millions of dollars ($3,960,000), and still further amounts were required.

This expenditure has been wisely incurred. The United States census of 1880 is, beyond doubt, more wisely planned and more thoroughly executed than any similar work which has been attempted in any other country. Of the more than fifty millions of people living in the United States on the 1st day of June, 1880, the age, sex, residence, and place of birth are given; the special employment or avocation of each of them engaged in any industrial occupation is noted, with the total value of the products of their labor; and as nearly as possible the average amount of wages earned. The capital invested in all great industries is shown, and the value of all products is stated. The domestic animals also come within the scope of the census. We are told how many cattle and horses, mules and asses, sheep and swine there are, not only in each State of the Union, but in each county. In brief, there is hardly anything which enters into the material welfare of the people which does not here find a place. The bare "Compendium of the Census Report," which consists mainly of tabulated figures, comprises two large volumes, and the complete Report, if printed in ordinary volumes, would contain matter enough to constitute a respectable school library.

Few persons have at their disposal the time which would be required to read, even in the most cursory manner, such an enormous mass of matter. It has been attempted in this volume to select and arrange the most important facts in the Census Report which bear most directly upon the question of the attainment of success in life. But we have by no means confined ourselves to this great storehouse of information. The successive reports of the Agricultural Department are hardly less important than those of the Census Bureau; and many other public and private documents have been consulted throughout the months which have been devoted to the preparation of this volume. It has, moreover, been a special object to compare the present condition of each subject with the past, in order to be able to form some estimate of what may be anticipated in the near future. We touch in detail upon some of the main features of the book, in order to show how the information embodied bears upon the condition and welfare of the various classes of society.

Population.—It is obvious that the total population of a country, and the ratio which it bears to the area of territory, lie at the very basis of all statistics. Without knowing this, we know scarcely anything of a people. But our population differs from that of every other civilized country in this, that a very notable proportion of it are emigrants from other lands; and it is of importance to know whence come these accessions to our population, and in what sections of the country they chiefly take up their residence. Besides this, and perhaps of more consequence, is the fact that there is a vast migration of native-born citizens from one section or state to another. Now, men migrate mainly in hope to improve their condition; and when there is a strong and continuous current of migration in any direction, and little or no return flow, it is *primâ facie* evidence that the conditions of life have, upon the whole, been found more favorable in the direction *to* which the movement is directed than in that *from* which it tends.

It by no means follows that everybody should migrate from his home, even if some other section presents some superior natural advantages; for there are few regions from which one can change his residence without some cost and inconvenience, and without giving up many advantages. But if for any reason one purposes to emigrate, it befits him to go where the advantages of a change seem to be the greatest. That many others circumstanced like himself have found any particular section favorable to them is one evidence that he will also find it so. It is in this respect that the chapter on migrations will be found valuable. The table accompanying this chapter shows *from* what States and sections emigration goes, and *to* which it comes.

But there are other factors which enter into the solution of the problem of emigration. While it is true that it is safe to go where many others have gone with advantage, it by no means follows that it is *not* wise to go where few others have already gone. For example, the emigration from the North to the South, and *vice versâ*, has hitherto been very limited. Some of the chief circumstances to which this is owing no longer exist; and there can be no reason to doubt that very many Southern men would now find better opportunities at the North, and very many Northern men better opportunities at the South. The question, in any case, hangs upon the special capacities and inclinations of the individual, and the answer should be given after a full examination of all the data supplied in this volume.

Farming.—That agriculture, in its widest acceptation, will for a long time form the greatest American industry is certain, from the fact of the great area of our country as compared with its population, and the increasing demand from abroad for our food-products. We shall have to supply not only our own rapidly-increasing population, but to furnish much to large portions of Europe. Great Britain, France, Germany, and some other countries of Europe, must look to us for much of their food, and for it they must pay us prices at which we can afford to produce it. So long as agriculture shall be more profitable than other occupations, it will attract more and more of our industry. Much space has therefore been devoted to the agricultural statistics of the present time, and of the last decade.

Each of our great crops has been taken up in order. The value of the whole crop, and the average value per acre, has been laboriously detailed; and means have been suggested by which the amount of the crops may be greatly increased. It is shown that by a wise selection of seed-grain, and by more judicious cultivation, the product of the acreage now under cultivation might be made twice as great as it now is. In this respect the Reports of the Agricultural Department have been found of high value.

FRUIT-CULTURE AND GARDENING.—The products of the Garden, the Orchard, and the Vineyard, as distinguished from the great cereal crops, are just beginning to receive the attention which they deserve. Full and accurate statistics as to these are not as yet attainable; but enough is at hand to show beyond question that these avocations present great opportunities to very many persons in every section of the country. The information conveyed in relation to the advantages of the cultivation of the orange and the grape in California, the orange in Florida, the peach and the pear in various sections, and the hints and suggestions as to the apple-culture in the more Northern States, should be of great value to the orchardist and the gardener.

LIVE-STOCK AND DAIRY PRODUCTS.—In respect to these great interests the means of information are unusually ample. Statistics evince the almost unequalled growth of these industries, placing them at present, and still more so in the future, as among the foremost of the advancing industrial interests of the United States—industries connected with many others, and in which there is scarcely a possibility of rivalry.

FORESTRY.—In nothing else have the American people been so deplorably culpable as in the manner in which they have treated, and are now treating, the native forests in every section of the Union. It has been one of the chief aims of this volume to show that this is the most vitally important problem with which this generation is concerned. A country bared of its trees is a ruined country, as is abundantly evinced by all human history; and we are working this ruin at a rate to which there is no parallel. The general relations of forests to the water-supply of a country is dwelt upon at length; for, next to air, water is the thing essential to all animal and vegetable life. Of incalculable importance, also, is the due supply of wood for lumber. Without this there is scarcely an industry that would not languish and fall into decay. It is shown that at the present rate of wanton destruction the supply of white-pine—our most valuable timber-tree—will be practically exhausted in less than ten years; that the yellow-pine and cypress of the South will last only a few years more; and that the noble red-wood of California is threatened with speedy extinction by native carelessness and foreign greed. It is urged that not another acre of the forest-land still in possession of the National Government be granted to any railroad or other corporation, or be sold to any individual purchaser, but that the whole shall be conserved as timber-land for this generation and for those who shall come after us.

The Manufacturing and Mechanical Industries of the country have received full and careful consideration. An earnest attempt has been made to show, by an ample array of statistics, what is the present condition and what the future prospect, of each of the great trades and occupations. The numbers engaged in each section of the country have been collated, and the wages paid have been gathered from all authentic sources. The statistics of the principal cities, in this respect, are especially valuable, because they affect greater numbers, and can be ascertained more accurately, than is possible in the country and in small villages. The effect which the introduction of machinery into mechanical and manufacturing industries has upon the condition and prospects of working-men and operatives has been made the subject of special consideration. The general conclusion arrived at is, that if proper training and education be received by those especially interested the ultimate result will continue to be favorable, as it certainly has been hitherto. It is not, however, lost sight of that in many individual cases great hardship has been, and will be, occasioned from the displacement of human labor by machinery, and suggestions have been made for the benefit of those who are likely to be involved in this competition.

Trade and Commerce.—Every person, no matter what his employment, is to a certain extent a trader. The workman sells his labor, the manufacturer his wares, the professional man his science and skill; and every one who sells anything must buy something, or else what he sells is a sheer loss to him. A survey has been attempted of the purely trading interests of the country, including those involved in the transportation of wares and goods rather than their production, with a view to ascertain wherein are to be found opportunities for success, and to point out the special qualifications requisite for its attainment.

The Mines of the United States will probably in time come to be more important than those of all the rest of the world. We have iron and copper to any amount that can ever be required. A third of the world's gold, and half of the silver, are now produced within our territory. There is, indeed, no important metal except tin for which we need look abroad; and it is confidently asserted by some that there are tin mines yet to be discovered and developed. This, however, for the present, may be considered problematical. Our supply of coal is inexhaustible within any assignable number of centuries; and there is no likelihood that petroleum will be largely found elsewhere, or that we shall be unable to supply all that the world will ever need. The mining statistics of the country have, therefore, been carefully elaborated, with constant reference to the inducements presented for persons in the practical work of mining, and more especially in those departments in which science and skill are required.

The Fisheries are considered as fully as the somewhat defective materials attainable would permit. There are, however, quite sufficient data to show that the artificial breeding and rearing of fish must come to be a very important industry, and one every way worthy of the consideration of those who are in a position to enter upon it. The United States Fishery Commission has done and is still doing a most valuable work in developing our industrial capabilities.

THE PROFESSIONAL OCCUPATIONS have been duly considered. Those especially which have a direct bearing upon the building and adornment of home are dwelt upon in detail. It has been the aim here to indicate how we should build our dwellings, and by what means we should beautify and adorn them. It is the people that here stand in need of instruction and advice. When they know what kind of houses to build, suitable for the various extremes of our climate, and how those houses may best be warmed, lighted, and decorated, there need be no fear that persons will be found ready to qualify themselves for these labors. Architects and artists may rest satisfied that opportunities for them will increase with the growth of the country in wealth and refinement.

THE APPLIED SCIENCES, AND INVENTIONS.—The opportunities which already exist or may be created for the profitable application of scientific, artistic, and inventive skill and knowledge are kept steadily in view throughout nearly every chapter, and in relation to almost every subject treated of. "The more skilful the labor, the greater the remuneration which it will receive," is the cardinal principle of this volume.

HEALTH AND MORTALITY.—The annual death-rate of each State is given, and the kinds of diseases specially prevalent in various sections, as nearly as they can be ascertained from the investigations of the Census Bureau. The information thus embodied will be of more special value to those who contemplate a change of residence from one section to another, whether for health or any other reason.

WORK FOR WOMEN.—Special care has been taken to point out what are the avocations in which women are now engaged; in what proportion they are employed; and what remuneration they receive as compared with that paid to men in similar work in those employments in which both sexes are to any extent engaged. An attempt has been made to show why it is that, as a rule, women receive less remuneration than men, and to indicate what may be done to remove this disparity. It is urged that like work should receive like pay, altogether irrespective of the sex of the recipient. Various directions are indicated in which women may look for opportunities, together with hints and suggestions as to the requisites for success in each of them. It is hoped that the views here presented will do something towards the solution of a question of such vital importance.

Amusements.—While it is assumed that labor of some kind is and must be the rule in life for all men and women, the necessity for healthful recreation, not only for itself, but as one means of securing more and better work, is strenuously insisted upon. Suggestions are offered as to the kinds of amusements to be fostered, and the kinds to be discountenanced, together with some of the means by which innocent and beneficial public amusements may be provided.

In fine: in the view of this book honorable success in life is attainable by most men who are not disqualified by mental or physical infirmity from availing themselves of the opportunities which are placed within their reach; and this success will be, as a rule, in direct proportion to the sagacity with which they select their respective avocations, the knowledge and skill which they bring into exercise, and the honesty and integrity which they habitually maintain in all their dealings with others.

CHAPTER II.

WHO ARE SEEKING OPPORTUNITIES.

THE United States comprise thirty-eight States and nine organized Territories, including the District of Columbia, having a land-surface of 2,970,000 square miles, or 1,900,800,000 acres, including the as yet unorganized Indian Territory of 68,991 square miles. Besides these is Alaska, having 530,000 square miles, and only about 33,500 inhabitants, of whom not more than 500 are whites. The population of the Indian Territory and Alaska is not included in the census.

The population of the States and Territories on June 1, 1880, was 50,155,783. In 1870 it was 38,558,371: an increase in 1880 of 11,597,412, or 30.1 per cent. The males numbered 25,518,820, the females 24,636,963: an excess of males over females of 881,857, or 3.5 per cent. In thirty States and Territories the males outnumber the females; in seventeen the females outnumber the males.

Of the population 43,475,840 were of native birth, and 6,679,943—about one-eighth—of foreign birth. These immigrants come to us from about sixty countries. From each of the following nationalities there are more than 100,000: From Germany, about 1,967,000; Ireland, 1,854,000; Great Britain, 918,000; British America, 717,000; Sweden and Norway, 378,000; France, 107,000; China, 105,000. Of the total population, 43,402,970 are classed as whites; 6,580,793 as colored; 105,465 as Chinese; 66,407 as civilized Indians; 141 as Japanese.

Table I. shows for each State the area of land-surface; the number of inhabitants per square mile; the population in 1880 and 1870, with the ratio of increase; the number of males and females; and the number of native-born and of foreign-born inhabitants.

TABLE I.—AREA AND POPULATION.

States and Territories.	Area, Square Miles.	Persons to Square Miles in 1880.	Population, 1880.	Population, 1870.	Per Cent. of Increase.	Males.	Females.	Native-born.	Foreign-born.
Alabama.....	51,540	24.5	1,262,505	996,992	26.6	622,629	639,876	1,252,771	9,734
Arizona......	112,920	0.4	40,440	9,658	318.7	28,202	12,238	24,391	16,049
Arkansas	53,045	15.1	802,525	484,471	65.6	416,279	386,246	792,175	10,350
California....	155,980	5.5	864,694	560,247	54.3	518,176	346,051	571,820	292,874
Colorado.....	103,645	1.9	194,327	39,864	387.4	129,131	65,196	154,337	39,790
Connecticut .	4,845	128.5	622,700	537,454	15.8	305,782	316,918	492,708	129,992
Dakota	147,700	0.9	135,177	14,181	853.2	82,296	52,881	83,382	51,795
Delaware	1,960	74.8	146,608	125,015	17.2	74,108	72,500	137,140	9,468
Dist. of Col...	60	2960.4	177,624	131,700	34.8	83,578	94,046	160,502	17,122
Florida	54,240	5.0	269,493	187,748	43.5	136,444	133,049	259,584	9,909
Georgia......	58,980	26.1	1,542,180	1,184,109	30.2	762,981	779,199	1,531,616	10,564
Idaho	84,290	0.4	32,610	14,999	117.4	21,818	10,792	22,636	9,974
Illinois	56,000	55.0	3,077,871	2,539,891	21.1	1,586,523	1,491,384	2,494,295	583,576
Indiana......	35,910	55.1	1,978,301	1,680,637	17.7	1,010,361	967,940	1,834,123	144,178
Iowa.........	55,475	29.3	1,624,615	1,194,020	36.0	848,136	776,479	1,362,965	261,650
Kansas	81,700	12.2	996,096	364,399	173.3	536,667	459,429	886,010	110,086
Kentucky....	40,000	41.2	1,648,690	1,321,011	24.8	832,590	816,100	1,589,173	59,517
Louisiana....	45,420	20.7	939,946	726,915	29.3	468,754	471,192	885,800	54,186
Maine	29,895	21.7	648,336	626,915	3.5	324,058	324,878	590,053	58,883
Maryland	9,860	94.8	934,943	780,894	19.7	462,187	472,756	852,137	82,806
Massachus'tts	8,040	221.8	1,783,085	1,457,351	22.3	858,440	924,645	1,339,594	443,491
Michigan	57,430	28.5	1,636,937	1,184,059	38.2	862,355	774,582	1,248,229	388,508
Minnesota ...	79,205	9.8	780,773	439,706	77.5	419,149	361,624	515,097	267,676
Mississippi...	46,340	24.4	1,131,597	827,922	36.6	567,177	564,420	1,122,388	9,209
Missouri.....	68,735	31.5	2,168,380	1,721,295	25.9	1,127,187	1,041,193	1,956,802	211,578
Montana.....	145,310	0.3	39,159	20,595	90.1	28,177	10,982	27,638	11,521
Nebraska	76,185	5.9	452,402	122,993	267.8	249,241	203,161	354,988	97,414
Nevada......	109,740	0.6	62,266	42,491	26.5	42,019	20,247	36,613	25,653
N. Hampshire	9,005	38.5	346,991	318,300	9.0	170,526	176,465	300,697	46,294
New Jersey..	7,455	151.7	1,131,116	906,096	24.8	559,922	571,194	909,416	221,700
New Mexico .	122,460	1.0	119,565	91,874	30.1	64,496	55,069	111,514	8,051
New York ...	47,620	106.7	5,082,871	4,382,759	15.9	2,505,322	2,577,549	3,871,492	1,211,379
N. Carolina ..	48,580	28.8	1,399,750	1,071,361	30.6	687,908	711,842	1,396,008	3,742
Ohio.........	40,760	78.5	3,198,062	2,665,260	19.9	1,613,936	1,584,126	2,803,119	394,943
Oregon	94,560	1.8	174,768	90,923	92.2	103,381	71,387	144,265	30,503
Pennsylvania.	44,985	95.2	4,282,891	3,521,951	21.6	2,136,655	2,146,236	3,695,062	587,829
Rhode Island	1,085	254.9	276,531	217,353	27.2	133,030	143,501	202,538	73,993
S. Carolina...	30,170	33.0	995,577	705,606	41.0	490,408	505,169	987,891	7,686
Tennessee ...	41,750	36.9	1,542,359	1,258,520	22.5	769,277	773,082	1,525,657	16,702
Texas........	262,290	6.1	1,591,749	818,579	94.4	837,840	753,909	1,477,133	114,616
Utah	82,190	1.7	143,963	86,786	65.8	74,509	69,454	99,969	43,994
Vermont.....	9,135	36.4	332,286	330,551	0.5	166,887	165,399	291,327	40,959
Virginia	40,125	37.7	1,512,565	1,225,163	23.4	745,589	766,976	1,497,869	14,696
Washington .	66,880	1.1	75,116	23,955	213.5	45,973	29,143	59,313	15,803
West Virginia	24,645	25.1	618,457	442,014	39.9	314,495	303,962	600,192	18,265
Wisconsin ...	54,450	24.2	1,315,497	1,054,670	44.7	680,069	635,428	910,072	405,425
Wyoming....	97,575	0.2	20,789	9,118	127.9	14,152	6,637	14,939	5,850
Totals...	2,970,000	......	50,155,783	38,558,371	.....	25,518,820	24,636,963	43,475,840	6,679,943

The respective ages of the entire population were, in round numbers, about as follows:

Under ten years...............	13,500,000	Between forty and fifty..........	4,500,000
Between ten and twenty.......	10,500,000	Between fifty and sixty..........	3,200,000
Between twenty and thirty.....	9,200,000	Between sixty and seventy.......	1,900,000
Between thirty and forty	6,400,000	Between seventy and eighty......	800,000

Eighty and over............ 220,000

All one's plans of life and operations in business should be materially modified by his age, and especially by the probable future duration of his life. Nothing is more uncertain than the duration of the life of any particular individual, of whatever age; but few things are more certain than the average life of a large number of individuals, of any given age, and under the ordinary conditions of human existence. Hence the business of life insurance has come to be an almost exact science. The figures in Table I. take in every individual of the fifty million residents of the United States. From them the following general conclusions may be deduced:

If a person in ordinary health has reached the age of ten, the probabilities are about as 10 to 13 that he will reach twenty; if he has reached twenty, it is as 9 to 10 that he will attain to thirty; if he has reached thirty, it is as 2 to 3 that he will live till forty; if he has reached forty, it is also nearly 2 to 3 that he will reach fifty; if fifty, it is nearly 3 to 4 that he will reach sixty. After sixty the probabilities of life diminish with constantly increasing rapidity. A little more than one-half who had reached sixty attained to threescore and ten; and of those who had reached seventy only a little more than one-fourth attained to fourscore. Of the fifty millions people of the United States only about 220,000—a little more than one in two hundred and twenty-five—are reported as having overpassed their eightieth birthday.

CHAPTER III.

WHERE OPPORTUNITIES ARE SOUGHT.

THE migration of the population—that is, the removal of people from the place of their birth, in order to find new homes in some other region—is a very important element in the problem before us. Almost every person has occasion, at one time or another, to determine whether he will remain in the place of his birth or present residence, or will remove to another. Probably less than one-half of our entire population actually reside in the city or town in which they were born. A man is quite as likely to take his wife from an adjoining town as from his own. Any one of a score of circumstances may render it advisable for a person to remove from one neighborhood to another.

Where this movement is from one immediate neighborhood to another, with substantially the same surroundings, it cannot be properly styled a "migration"—by which we understand a removal from one country or state to another.

There are no means of ascertaining precisely the amount of the movement from one to another part of the same State; but the emigration from one State to another can be definitely ascertained. The birthplace of every individual is recorded; and from the elaborate tables in the Census Report we can ascertain just how many persons then living were born in each several State, how many of them reside there, and how many have emigrated to another State, and also how many persons have immigrated to that State from each of the others. Every "migrant" is an *emigrant* from the State *from* which he removes, and an *immigrant* to that State *into* which he removes.

The totals of the emigration and of the immigration will therefore be equal.

TABLE II.—MIGRATIONS OF NATIVE POPULATION.

States and Territories.	Resident in State.	Born in State.	Born and Resident in State.	Emigration from State.	Immigration into State.
Alabama	1,252,771	1,319,189	1,014,633	304,556	238,138
Arizona	24,391	9,089	8,166	923	16,225
Arkansas	792,175	520,740	436,677	84,063	355,498
California	571,820	355,157	326,000	29,157	245,820
Colorado	154,537	31,827	26,363	5,464	28,174
Connecticut	492,703	538,832	398,211	140,621	94,492
Dakota	83,832	20,640	17,796	2,844	66,036
Delaware	137,140	155,517	110,643	44,874	26,497
District of Columbia	160,502	102,428	80,702	21,726	79,800
Florida	259,584	194,518	173,481	21,037	86,103
Georgia	1,531,616	1,719,068	1,395,214	323,854	136,402
Idaho	22,636	7,753	5,992	1,761	16,644
Illinois	2,494,295	2,263,409	1,709,520	553,889	784,775
Indiana	1,834,123	1,798,480	1,354,565	443,915	479,558
Iowa	1,362,965	954,695	737,306	217,389	625,659
Kansas	886,010	279,151	233,066	46,085	652,944
Kentucky	1,589,173	1,856,310	1,402,112	454,198	187,061
Louisiana	885,800	817,492	728,322	89,170	157,478
Maine	590,053	745,272	563,015	182,257	27,038
Maryland	852,137	958,141	762.641	195,500	89,496
Massachusetts	1,339,594	1,356,295	1,088,565	267,730	256,029
Michigan	1,248,429	920,661	803.306	177,355	445,123
Minnesota	513,097	341,750	302,371	39,379	210,726
Mississippi	1,122,388	1,056,993	863,185	193,808	359,203
Missouri	1,956,802	1,567,284	1,268,641	298,643	688,161
Montana	27,638	8,687	7,225	1,462	20,413
Nebraska	354,988	113,478	95,790	17,688	259,198
Nevada	36,613	18,256	13,732	4,524	22,881
New Hampshire	300,697	371,262	242,757	128,505	57,940
New Jersey	909,416	906,205	725,614	180,591	183,802
New Mexico	111,514	113,788	101,046	12,742	10,468
New York	3,871,492	4,753,547	3,556,394	1,197,153	315,098
North Carolina	1,396.008	1,638,058	1,344,553	293,505	51,455
Ohio	2,803,119	3,302,656	2,361,437	941,219	441,682
Oregon	144,265	81,608	67,942	13,666	76,323
Pennsylvania	3,695,062	4,184,180	3,385,693	798,487	309,369
Rhode Island	202,538	201,722	152,487	49,235	50,051
South Carolina	987,891	1,183,311	952,395	230,916	35,496
Tennessee	1,525,657	1,787,504	1,313,552	473,952	212,105
Texas	1,477,133	915,020	870,705	44,315	606,428
Utah	99,969	92,130	81,716	10,414	18,253
Vermont	291,327	438,041	251,780	186,261	39,547
Virginia	1,497,869	2,118,460	1,435,124	683,336	62,745
Washington	59,313	22,425	19,359	3,066	39,954
West Virginia	600,192	440,213	397,267	42,946	202,925
Wisconsin	910,072	893,945	693,177	200,766	216,895
Wyoming	14,939	4,091	2,299	1,792	12,740

Table II. embodies the most important results of the elaborate tables contained in the Census Report, so far as the native-born residents are concerned. Column 1 gives the number of persons born in the United States residing in each of the respective States. Column 2 gives the number born in a certain State, but residing in other parts of the Union. Column 3 gives the number born in a State and actually residing there. By subtracting the figures in column 3 from those in column 1 we find the number (as shown in column 5) who have *immigrated* to the State named, as, of course, every resident not born there must have come from another State. So, too, by subtracting the figures in column 3 from those in column 2 we find the number (as shown in column 4) who have *emigrated*, because every person born in a certain State, but not residing there, must have removed from the State of his birth.

It will be seen that about one-fourth of the native population of the United States have emigrated from the various States in which they were born. Now, every person who migrates does so with the hope of improving his condition in some respect. If we find that very many more people leave a State than come into it, it is evident the general judgment is, that they may do better elsewhere. If many more people migrate to a State than from it, it is a strong argument in favor of the superior advantages of that State. If the emigration and the immigration nearly balance each other, it is a pretty sure indication that the advantages and disadvantages are, upon the whole, about equal, as compared with other States.

In designating any State or section as emigrating or immigrating regard must be had to the ratio which these two movements bear to each other. In some States these movements are very nearly equal. For example, New Jersey has sent 181,000 persons to other States, while she has received 185,000. Of the 181,000 who have emigrated, 47,000 have gone to New York, 45,000 to Pennsylvania, 14,000 to Illinois, 10,000 to Ohio, and so on in less numbers to every State in the Union.

Of living persons born in New York—1,197,000—one-fourth of the whole have gone to other States: 230,000 to Michigan, 120,000 to Illinois, 100,000 to Pennsylvania, 95,000 to New Jersey, 86,000 to Wisconsin, 82,000 to Iowa, 64,000 to Ohio, 47,000 to Minnesota, 44,000 to California, 43,000 to Kansas, 39,000 to Connecticut, 36,000 to Massachusetts, while barely 30,000 have gone to the eleven Southern States. From other States New York has received 315,000 persons, of whom 56,000 were from Pennsylvania, 47,000 from New Jersey, 43,000 from Massachusetts, 39,000 from Connecticut, 31,000 from Vermont, and barely 25,000 from the eleven Southern States, half of whom are from Virginia.

Of those born in the six New England States, 950,000—one-fourth of the whole—do not reside in the State in which they were born. But these States form in most respects a homogeneous section, presenting few differences in soil, climate, productions, and industries; and the very considerable intermigration between these States should be considered as an interchange of population rather than emigration. The main current of true emigration from New England runs a little south of west, through New York and Michigan, to Illinois and Iowa; then bends north-westward to Wisconsin and Minnesota. The emigration from New York takes the same general course.

Southern emigration presents two strongly-marked currents, one a little to the north or west, the other to the south-west. Thus, Virginia and North Carolina have sent out 875,000 emigrants, of whom nearly 140,000 halted in West Virginia, and more than 300,000 pressed westward through Kentucky, Ohio, Indiana, and Kansas. About 360,000 went south-westward, through Tennessee and Arkansas, to Texas, branching off southward to Alabama, Mississippi, and Louisiana.

As there is a strong westward current of emigration from the more easterly of the Western States, so there is a like southward current from the more northern of the Southern States. Ohio sends a strong current of emigration to Indiana, and Indiana to Illinois; Tennessee to Arkansas, and Arkansas to Alabama. And to all these great flood-tides of migration there is no returning ebb-flow: no current of emigration eastward from the far West, none northward from the far South.

The most obvious inference to be drawn from this migration of population is: when there is a strong and continuous flow in any direction, it is most probable (if there be no special objection, such as an unhealthy climate and the like) that this is a safe direction for one to follow who has it in mind to seek a new home.

But it by no means results that one should of necessity follow the tracks of migration already worn. It may be, and most probably is, the case that there are quite different localities whose claims have, for one reason or another, been overlooked, or whose advantages have hitherto been overbalanced by disadvantages which have already ceased to exist, or are now passing away.

For example, very few emigrants have heretofore been attracted to the South from the Northern States or from Europe. Of the main underlying cause for this there is no question. That cause has ceased to exist, and it is safe to predict that no long period will elapse before numerous emigrants from the North and the East and from Europe will make their homes in Virginia and Tennessee, in Georgia and Texas, as well as in Illinois and Iowa, in Kansas and Wisconsin. While it may be assumed that all the regions to which emigration strongly tends are good ones, it does not follow that they are the best ones. The wise person who contemplates emigration will inquire whether there are not new fields for him even better than the older ones. Our country is so vast that we have only begun to learn its capabilities for the enterprising and industrious.

There is no returning flow of emigration from America to Europe to offset the tide of immigration from Europe to America. Only a few thousand natives of the United States have sought homes in Europe, while more than six and a half millions of Europeans have found homes in the United States. The distribution of this population of foreign birth presents some points of interest. In several of the larger States it constitutes a very considerable percentage of the whole. In California and Wisconsin about one-third of the population are of foreign birth; in New York, nearly one-fourth; in Illinois, one-fifth; in the New England States and Iowa, one-sixth; in Pennsylvania, one-eighth. In Texas and Louisiana together it is one-fifteenth. In the nine other Southern States, with a population of 10,500,000, there are only about 90,000—one in one hundred and fifteen—persons of foreign birth. New York has more Irishmen than any city of Ireland, except Dublin; there are only six cities in Germany which have more Germans than New York.

In certain respects the opportunities for success can best be studied in cities and large towns. The wages paid for any given kind of industry have a strong tendency towards uniformity. Few mechanics or operatives, except in instances of special skill, receive much more, and few much less, than the general average of their fellow-craftsmen in cities. The amount of capital invested in any department of industry, the cost of raw material, and the amount of wages paid, can be very nearly ascertained; and thus some sure steps can be taken towards the solution of those great social and economic problems of the day which bear upon success in life.

There is a tendency in some of the States for people to mass together in cities. This tendency manifests itself most strongly in the older and more densely peopled sections of the country. In several States the increase of population during the last ten years has been mainly confined to a few of the larger cities, while the rural population has been almost stationary.

In the State of New York the increase between 1870 and 1880 was about 700,000, or sixteen per cent.; of this increase 592,000 was in the seven cities each having more than 50,000 inhabitants, while the population of the remainder of the State increased only half as much as the city of New York has done. Of the sixty counties, only the seven which contain those large cities show any marked increase, while in eight counties there was a slight decrease.

In Massachusetts the increase between 1870 and 1880 was 336,000, or 22 per cent.; of this increase three-fourths was in Boston and the thirteen cities each having more than 20,000 inhabitants. In Connecticut the increase was 85,000—17 per cent.—of which more than one-half was in the thirteen cities having each a population of more than 15,000. In New Jersey the increase was 225,000, or 25 per cent., of which 175,000 was in the seven cities having more than 25,000 inhabitants. In Pennsylvania the increase was 760,000, or 22 per cent., of which nearly one-half was in Philadelphia and ten other cities, each having a population of more than 25,000.

Taking into account that, besides these fifty large cities, there are in these nine States fully sixty other cities with a population of more than 10,000 each, it appears that the rural population of the manufacturing section of the country is almost stationary, the increase being in the urban population.

In the South the ratio of increase between the dwellers in the country and those in towns was very different. In Georgia the total increase was 358,000, or 30 per cent., of which only 29,000 was in the five cities having more than 10,000 inhabitants. In Kentucky the increase was 227,000, or 25 per cent., only 33,000 being in the three cities with a population of more than 20,000. In Tennessee, out of an increase of 284,000, or 23 per cent., there was 18,000 in the three cities having more than 10,000 inhabitants. In Texas the increase was 773,000, or 94 per cent., the three cities having each more than 10,000 inhabitants, gaining only 41,000. In Virginia the increase was 287,000, or 23 per cent., of which 26,000 was in the six cities having more than 10,000 inhabitants. One of the most characteristic features of social life in all of the Southern States is the strong preference of the people for country life, and the disinclination to aggregate themselves in large towns. In all the Southern States, New Orleans, Richmond, and Charleston are the only cities with a population of more than 40,000.

The Western and North-western States occupy, in this respect, a position midway between those of the South and those of the North-east. In Illinois the increase between 1870 and 1880 was 583,000, or 21 per cent., of which 236,000 was in Chicago and the ten other cities having a population of more than 10,000. In Indiana the increase was 298,000, or 18 per cent., of which 69,000 was in the nine cities with more than 10,000 inhabitants. In Michigan the increase was 452,000, or 38 per cent., of which 87,000 was in the seven cities with more than 10,000 inhabitants. In Missouri the increase was 447,000, or 26 per cent., of which 77,000 was in St. Louis and the three other cities with a population of more than 10,000. In Ohio the increase was 538,000, or 20 per cent., of which 197,000 was in Cincinnati, Cleveland, and the fifteen other cities having more than 10,000 inhabitants.

Taking the entire United States together, the population residing in cities and towns of more than 8000 inhabitants increases in a greater ratio than the rural population. This is not owing to the natural increase, but to removals from the country to cities. In 1800 one twenty-fifth of the entire population lived in 6 such cities; in 1810, one-twentieth in 11 cities; in 1820, one-twentieth in 13 cities; in 1830, one-sixteenth in 26 cities; in 1840, one-twelfth in 44 cities; in 1850, one-eighth in 85 cities; in 1860, one-sixth in 141 cities; in 1870, a little more than one-fifth in 226 cities; in 1880, a little less than one-fourth in 286 cities.

In 1880 the urban population numbered 11,387,000, being 22.5 per cent. of the whole. There were in that year four cities with a population of more than 500,000; five with between 200,000 and 500,000; ten with between 100,000 and 200,000; sixteen with between 50,000 and 100,000; forty-one with between 25,000 and 50,000; two hundred and ten with between 8000 and 25,000.

The distribution of the population into families, and the number of families occupying a single dwelling, is important in many respects, especially as bearing upon health. According to the Census Report of 1880 there were in the United States 9,945,916 families, averaging 5.4 individuals to each. There were 8,955,812 dwellings, averaging 5.60 occupants to each. Thus, in the great majority of cases a single family occupied a dwelling. But in some entire States the proportion was much less. Thus, in New York 772,512 dwellings were occupied by 1,078,905 families, being 6.58 persons to a dwelling. In Massachusetts 281,188 dwellings were occupied by 379,710 families, being 6.34 persons to a dwelling. In Rhode Island there were 41,388 dwellings and 60,259 families, or 6.68 persons to a dwelling.

In most large cities and manufacturing towns the disproportion between the number of families and dwellings is very apparent. In Philadelphia there were 146,412 dwellings and 165,044 families, being 5.79 persons to a dwelling. In Brooklyn, 62,233 dwellings and 115,076 families, being 9.11 persons to a dwelling. In Chicago, 61,069 dwellings and 96,992 families, being 8.24 persons to a dwelling. In Lowell, 8245 dwellings and 11,439 families, being 7.21 persons to a dwelling. In Lawrence, 4608 dwellings and 7488 families, being 8.50 persons to a dwelling. In the city of New York this disproportion is greater than anywhere else: here there were 73,684 dwellings and 243,157 families, being 16.37 persons to a dwelling. But here an apartment-house or tenement-house is regarded as a single dwelling, no matter how great its size.

It has been said by some that the occupancy of a dwelling by more than one family is prejudicial to health. If that were so the number of persons to a family would be notably below the general average of 5.4; for the number of deaths to a family would, as a rule, be greater, and so the number of living members smaller. In those cities where a considerable number of families are crowded together in large "tenement-houses" this is certainly the case. Thus, in New York there are 4.97 persons to a family; in Brooklyn, 4.92; in Boston, 4.99; in Cincinnati, 4.90. But the rule, in this respect, as to cities and manufacturing towns in general is rather the reverse, the number of persons to a family being usually above the general average. Thus, in Philadelphia there are 5.13 persons to a family; in Chicago, 5.19; in St. Louis, 5.38; in Pittsburg, 5.24; in Lowell, 5.20; in Lawrence, 5.23.

The mere fact that several families occupy a single "dwelling"—that is, are covered by a single roof—seems to have in itself no bearing upon the question of health. That rests upon quite different grounds.

CHAPTER IV.

THE OCCUPATIONS WE FOLLOW.

EVERY human being must live by labor, performed by himself or by some other person for him, or by both. The child lives by the labor of his parents; the person who has inherited wealth, by the labor of those from whom he has inherited it. The employer lives partly by his own immediate labor in managing his business, and partly by a share in the products of the labor of his employés. The pauper is supported by the conjoint labor of the rest of the community; the thief or the swindler, by the labor of those upon whom he preys.

To this general law there is no exception. Excepting the air he breathes, Nature gives to man nothing which he can make available to supply his wants unless he works for it. The aborigines of Australia and the "Digger" Indians of our Pacific coast, who live upon roots, berries, nuts, and shell-fish, must dig their roots, pick their berries and nuts, gather their crawfish, and perhaps build a fire and cook their food before they can eat it. Every article of clothing, of comfort, and adornment is the direct product of labor. The rudest shelter from the weather requires labor; caves and holes in the rocks demand and receive some labor in order to make them habitable even by the rudest savage.

To ascertain the direction in which this labor is turned, the various avocations in which it is employed, with the number of persons who are busied in each avocation, the value of the products, and, as nearly as may be, the average amount of the earnings of each person employed, is a matter of prime importance. Among the things to be considered are the total amount of the products of each of the chief branches of industry; the amount of capital required to carry it on; the cost of the raw material, and of the labor expended upon it. Of the highest importance also is a knowledge of the localities best suited to the several occupations; of the climate, soil, and principal productions as they are now or may be made to be; the condition of society, social, moral, and educational. When a person has acquired a fair knowledge upon these points, he will be in a condition to judge whether any other location is better adapted to his capacities and inclinations than the one where he now resides.

The census of the United States undertakes to give, not only the total number of persons engaged in all lawful and gainful occupations, but also the number in nearly four hundred special branches, giving the age and sex, the State and county in which each resides. This information is amplified and detailed under each general department, so as to include full statistics as to the capital employed in each industry, the value of its products, the cost of raw material and labor, thus to a good degree indicating the entire cost of production, and the resulting amount of profit.

Those engaged in any of these occupations constitute the "producing classes;" those not so engaged, the "non-producing classes." The producing classes, as enumerated in the census, include only a part of the entire population. The principal classes not included are: 1. All children below the age of ten years. 2. A majority of females above that age who live at home, without having special employment from which they derive an income. 3. Males beyond the age of sixteen who are pursuing courses of study, or are prevented by age or by permanent mental or physical infirmity from engaging in any industrial occupation. 4. Paupers and criminals. 5. All persons whose means of livelihood are, in the general judgment of mankind, criminal or disreputable.

The "industrial classes," thus limited, number 17,392,099, being 34.68 per cent. of the entire population, and 47.31 per cent. of those of ten years and upward. The census groups them into four grand divisions:

I. Agriculture.—This includes not only farmers, planters, and agricultural laborers, but also dairymen, gardeners, vine-growers, and raisers and herders of live-stock.

II. Professional and Personal Services.—This includes not only clergymen, lawyers, physicians, teachers, artists, etc., and domestic servants, but also more than forty other avocations, among which are soldiers and sailors, those in the employment of the general, State, or municipal governments; barbers, hotel-keepers, and all laborers not specially included in one of the other grand divisions.

III. Trade and Transportation.—This includes merchants, traders, and bankers; clerks, salesmen, commercial travellers, and accountants in stores; saloon-keepers and bar-tenders; draymen and teamsters; officers and employés of railroad, telegraph, express, and transportation companies, etc.

IV. Manufacturing, Mechanical, and Mining.—This includes in all more than two hundred distinct industries and occupations. The Fishing Industry is also included in the division of Manufactures.

Table III. gives a condensed summary of these four grand industrial divisions, with the number of persons engaged in each of them, and their respective ages and sex:

TABLE III.—INDUSTRIAL OCCUPATIONS.

Classes.	Persons Occupied.	Age and Sex.							
		All Ages.		10 to 15.		16 to 59.		60 and over.	
		Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Agricultural......	7,670,493	7,075,983	594,510	584,867	135,862	5,888,133	435,920	602,983	22,728
Professional and personal services	4,074,238	2,712,943	1,361,295	127,565	107,830	2,446,962	1,215,189	138,416	38,276
Trade and transportation......	1,810,256	1,750,892	59,364	26,078	2,547	1,672,171	54,849	52,643	1,968
Manufacturing, mechanical, and mining........	3,837,112	3,205,124	631,988	86,677	46,930	2,978,845	577,157	139,602	7,901
Totals........	17,392,099	14,744,942	2,647,157	825,187	293,169	12,986,111	2,283,115	933,644	70,873

In this table 32,763,684 of the inhabitants of the United States—65.32 per cent. of the entire population—are not accounted for as having any industrial occupation. Of these non-producers 13,394,076—18.01 per cent.—were below the age of ten. There still remain 36,761,607 above that age, of whom 19,369,508 (15,378,470 females, and 3,991,038 males), or 52.69 per cent., are not reckoned among those constituting the producing classes. Of those not accounted for, 5,531,127, of both sexes, are between ten and fifteen: this number approximates very closely to the number of children attending school, who do not pursue any gainful occupation during any considerable portion of the year.

Between sixteen and fifty-nine there were 13,907,444 males, of whom 991,333 are not accounted for. This number consists principally of students in colleges, of those mentally or physically disabled for labor, and of criminals and paupers. Of the 13,377,002 females of this age, 11,093,887 are not set down as having any industrial occupation. A very considerable portion of these, however, do not really belong to the non-producing class. They are the wives and grown-up daughters of farmers, mechanics, traders, and other producers, and are to a very great extent busied in household and domestic labors, and are as really producers as though they received direct wages.

Taking the entire data furnished in the Census Tables, it appears that nearly two-thirds (65.32 per cent.) of the population are supported by the labor of a little more (34.68 per cent.) than one-third—that is, taking the workers of every age and occupation together, each one supports, upon an average, not only himself or herself, but nearly two other persons. But there are considerable numbers the products of whose labor is barely sufficient for their own maintenance, and who do nothing towards the support of others. Of the more than a million of workers below the age of sixteen, probably a majority do not fully support themselves. Probably only a minority of those under twenty earn more than enough to maintain themselves. Leaving all these out of view, it may be fairly assumed that, of the workers who do more than maintain themselves, each, upon an average, supports himself and three others.

But the members of the industrial class produce more than enough for their own support and for that of those dependent upon them, including the pauper and criminal classes. This overplus appears in the shape of the increased wealth of the general community. This increase in wealth is the result of labor, bestowed, directly or indirectly, upon the object itself. The increased value of a farm arises either from the labor bestowed upon it or from its being made more accessible to a market by improved modes of communication, etc., or from both causes. But railroads and other means of communication are the products of labor; for "capital" is only another form of expression for the accumulated excess of the products of labor over the consumption of those products. For the present purpose it does not matter that these accumulations, to a very great extent come into the hands of a comparatively small portion of the producers—mainly those who by superior enterprise or skill—perhaps good-fortune—have been enabled to become employers, and thus have rightly earned a share in the products of the labor of their employés. The proper adjustment of the relative shares of these two classes of producers is the great problem which civilization has to solve; and every well-considered attempt to point out the directions in which, and the modes by which, labor can be more and more advantageously employed, will contribute something towards the solution of this problem.

The actual amount of the increase in the values of the various products of industry in the several States is shown in the chapters which treat specially of these industries. The following summation of the "assessed valuation" in 1870 and 1880 serves rather for the purpose of a general comparison between these two periods, than as showing the actual value of the real and personal property in the United States, since for purposes of taxation property is almost invariably assessed at much below its real buying and selling value. Moreover, in 1870 the assessed valuation was expressed in currency, while gold was at an average premium of 25.3 per cent. To render the comparison accurate, the reported values for 1870 should (as suggested by the Superintendent of the Census) be reduced to the gold standard—that is, one-fifth should be deducted from the values given in the Census of 1870. This will be done in this volume whenever such a comparison is instituted.

TABLE IV.—ASSESSED VALUATION, 1880, 1870.

	Real Estate.	Personal Property.	Total.
1880	$13,036,776,925	$3,866,226,618	$16,902,993,543
1870	9,914,780,825	4,264,205,907	14,178,986,732
	Inc., $3,121,996,100	*Dec.*, $397,979,289	*Inc.*, $2,724,006,811

But, reducing the total valuation for 1870 to gold, the true valuation for that year would be $11,343,187,396; and the real increase from 1870 to 1880 was $5,559,606,147. If the entire wealth of the country had been equally divided in 1870 among the population each would have received about $295 in gold. If it had been so divided in 1880 each would have received about $340. Or, to put the matter in another shape, if the *increase* of wealth in 1880 were divided among the whole reported industrial population there would be about $320 for each of them—that is, each working man, woman, and child has earned, upon an average, $32 a year above what has been required for their own maintenance and that of those rightfully dependent upon them, and for the support of paupers and criminals.

CHAPTER V.

FARMS AND FARM AREAS.

THE Census Report of 1880 shows that forty-four per cent. of all the persons pursuing any gainful occupation were engaged in agriculture in some of its departments. The ratio for the whole population is probably about the same, since the number of children and other non-producers is nearly alike in all the industrial classes. It is impossible to institute a comparison in this respect between the Censuses of 1880 and 1870, because a somewhat different mode of classification was adopted.

There is every reason to anticipate that the proportion of agriculturists to persons engaged in other employments will increase in the future. New labor-saving machinery is being constantly introduced, by means of which one factory operative or mechanic is able to do the work which formerly required the labor of many persons; hence a smaller proportion of hands is required to supply the demand for manufactured articles; and, although the cheapening of such productions largely increases the demand for them, it does not proportionally increase the number of workmen. And, moreover, a much larger proportion than formerly of emigrants engage in agriculture. Labor-saving machinery is, indeed, largely and increasingly introduced into agriculture, but not to the same relative extent as into manufactures. A few years ago the majority of emigrants from Europe remained in and about the cities; now more than half of them make no stay at the ports where they land, but go at once to the West, and become farmers or farm laborers. Besides all this, in most manufactures we have to compete in our own markets with Europe. In the products of agriculture we

PLOUGHING AND HARROWING IN DAKOTA.

See Note 2.

can have no rivals in our own markets, and we can outrival Europeans in their markets. Nothing can be more certain, for example, than that as England has been, and must be, dependent upon us for cotton, so she must, to a very considerable extent, be dependent upon us for breadstuffs and meat.

While, therefore, we must remain a great manufacturing nation, we shall undoubtedly become more pre-eminently an agricultural people, so long as lands open to culture are abundant and cheap. Farming, in its various modifications, demands the foremost place in our investigations into the subject of profitable employments. The term "farm," as used in the Census Report, is thus defined:

"A farm is what is owned or leased by one man and cultivated under his care. A distant wood-lot or sheep-pasture, even if in another subdivision, is treated as a part of the farm; but whenever there is a resident overseer or manager, there a farm is reported. Farms include all considerable nurseries, orchards, and market-gardens which are owned by separate parties, which are cultivated for pecuniary profit, and employ as much as the labor of one able-bodied man during the year. Mere cabbage and potato patches, family vegetable gardens, and ornamental lawns, not constituting a portion of a farm for general agricultural purposes, are excluded."

Table V. shows the number of farms in each of the States in 1880, their acreage and value, value including buildings; the percentage of increase in value since 1870; the value of farm implements and machinery; and the total value of farm products in 1879. The United States contain (exclusive of Alaska) about 1,900,000,000 acres of land-surface. How great a portion of this is capable of profitable cultivation is not accurately determined, but enough is known to show that the area of land incapable of cultivation is much less than was formerly supposed. None of our territory lies to the north of the zone of tillage; and the "great deserts" marked even upon quite recent maps are at most of comparatively limited extent. Immense tracts formerly supposed to be hopelessly arid and barren are now proved to be capable of being rendered highly fertile by means of proper irrigation, which can be supplied at a cost so moderate that the outlay will be amply repaid.

TABLE V.—FARMS: ACREAGE AND VALUES.

States.	Land Surface of the U. S.	Number of Farms.	Improved Land.	Value of Farms.	Value of Implements.	Per Ct. of Increase.	Value of Products, 1879.
	Acres.		*Acres.*	*Dollars.*	*Dollars.*		*Dollars.*
Ala.....	32,985,600	135,864	6,375,706	78,954,648	3,788,978	25.09	56,872,994
Arizona.	7,226,800	767	56,071	1,127,946	88,811	283.01	614,327
Ark. . . .	33,948,800	94,433	3,595,603	74,249,655	4,637,497	93.33	43,796,261
Cal.....	99,827,200	35,934	10,669,698	262,051,282	8,447,744	71.05	59,721,425
Col.....	66,268,800	4,506	616,169	25,109,223	910,085	544.06	5,035,228
Conn. . .	3,100,800	30,598	1,642,188	121,063,910	3,162,628	....	18,010,075
Dakota.	93,528,000	17,435	1,150,413	22,401,084	2,390,091	259.76	5,648,814
Del.....	1,254,400	8,794	746,958	36,789,672	1,504,576	6.99	6,320,345
D. of C..	38,400	435	12,632	3,632,403	36,798	52.82	514,441
Florida.	34,713,600	23,483	947,640	20,291,835	689,666	28.72	7,439,392
Georgia.	37,747,200	138,626	8,204,720	111,910,540	5,317,416	20.09	67,028,929
Idaho . .	53,945,600	1,885	197,407	2,832,890	363,930	64.20	1,515,314
Illinois..	35,840,000	255,741	26,115,154	1,009,594,580	33,739,591	35.10	203,980,137
Indiana.	22,982,400	194,013	13,933,738	635,236,111	20,476,988	37.89	114,707,082
Iowa . . .	35,504,000	185,351	19,866,541	567,430,227	29,371,884	111.42	136,103,473
Kansas.	52,288,000	138,561	10,739,566	235,178,936	15,652,848	444.03	52,240,301
Ky.....	25,600,000	166,453	10,731,683	299,298,631	9,734,634	32.42	63,850,155
La.	29,068,800	48,292	2,739,972	58,989,117	5,435,525	33.94	42,883,522
Maine..	19,132,800	64,309	3,484,908	102,357,615	4,948,048	19.43	21,945,489
Md.....	6,310,400	40,517	3,342,700	165,503,341	5,788,197	14.71	28,839,281
Mass....	5,145,600	38,406	2,128,311	146,197,415	5,134,537	22.58	24,160,881
Mich....	36,755,200	154,008	8,296,862	499,103,181	19,419,360	62.78	91,159,858
Minn. . .	50,681,200	92,386	7,246,693	193,724,260	13,089,783	212.07	49,468,951
Miss....	29,657,600	101,772	5,216,937	92,844,915	4,885,636	23.94	63,701,844
Mo.....	43,990,400	215,575	16,745,031	375,633,307	18,103,074	84.48	95,912,660
Montana	92,978,400	1,519	262,611	3,234,504	401,185	210.14	2,024,923
Neb....	46,758,400	63,387	5,504,702	105,932,541	7,820,917	750.76	31,708,914
Nevada.	70,233,600	1,404	344,423	5,408,325	378,788	271.76	2,855,449
N. H....	5,763,200	32,181	2,308,112	75,834,389	3,069,240	....	13,474,330
N. J....	4,771,200	34,307	2,096,297	190,895,833	6,921,085	6.06	29,650,756
N. Mex..	78,374,000	5,053	237,392	5,514,399	255,162	66.	1,897,974
N. Y....	30,476,800	241,058	17,717,862	1,056,176,741	42,592,741	13.37	178,025,695
N. C....	30,991,200	157,609	6,481,191	135,793,602	6,078,476	23.24	51,729,611
Ohio . . .	26,086,400	247,189	18,081,091	1,127,497,353	30,521,180	24.96	156,777,152
Oregon.	60,518,400	16,217	2,198,645	56,908,575	1,956,173	96.96	13,234,548
Penn. . .	28,780,400	213,542	13,423,007	975,689,410	35,473,037	16.56	129,760,476
R. I. ...	694,400	6,216	298,486	25,882,079	902,825	3.27	3,670,135
S. C. ...	19,308,800	93,864	4,132,050	68,677,482	3,202,710	37.25	41,969,749
Tenn. . .	26,720,000	165,650	8,496,556	206,749,837	9,054,863	24.01	62,076,311
Texas . .	166,865,600	174,184	12,650,314	170,468,886	9,051,491	326.67	65,204,329
Utah . . .	52,601,600	9,452	416,105	14,015,178	946,753	250.38	3,337,410
Vt.	5,846,400	35,522	3,286,461	109,346,010	4,879,285	.69	22,082,656
Virginia	25,681,000	118,517	8,510,113	216,028,107	5,495,114	.42	45,726,221
Wash.T.	42,803,200	6,529	484,346	13,844,224	958,513	15.22	4,212,750
W. Va..	15,772,800	62,674	3,792,327	133,147,175	2,669,163	46.97	19,360,049
Wis....	34,848,000	134,322	9,162,528	357,709,507	15,647,196	55.31	72,779,496
Wy. T. .	62,448,000	457	83,122	835,895	95,482	24,492.30	372,391
Totals	1,900,800,000	4,008,907	284,771,042	10,197,096,776	406,520,055	....	2,213,402,564

The number of acres of "improved land" was, in 1880, 284,771,042 — about one-seventh of the entire land-surface. This was divided into 4,008,907 farms, the average being about 71 acres to a farm. There were 4352 farms with less than 3 acres; 134,889 with from 3 to 10 acres; 254,749 with from 10 to 20 acres; 781,474 with from 20 to 50 acres; 1,032,910 with from 50 to 100 acres; 1,695,983 with from 100 to 500 acres; 75,972 with from 500 to 1000 acres; 28,578 with 1000 or more acres. In 1870 there were 188,921,099 acres of improved land, an increase in 1880 of 52 per cent. The ratio of increase in the several States is shown in the table. In 1880, besides the "improved land," there were 251,310,773 acres of "unimproved land in farms," making the entire farming area 536,081,835 acres.

The valuation of farms, including land, buildings, and fences, in 1880, was $10,197,096,776; in 1870 it was (in gold) $7,410,243,089, an increase in 1880 of 30.7 per cent., the ratio of increase being a mere fraction above that of the increase of population. The value of farming implements and machinery in 1880 was $406,520,055; in 1870 it was (in gold) $289,502,743, an increase in 1880 of 52 per cent.

The value of farms themselves has, since 1870, increased in a ratio somewhat greater than that of the increase of the population; and the value of the implements used in agriculture has increased in a higher ratio still. The inference is obvious: agriculture in general has been found a lucrative occupation. When we come to consider more in detail the special branches of agricultural enterprise, this conclusion will be even more thoroughly established.

CHAPTER VI.

FARM PRODUCTS.

TABLE VI. shows for each State the acreage devoted to each of the principal crops, and the amount produced of each in 1880. We take up the cereals in the order of their values:

The Cereals.

INDIAN-CORN.—Indian-corn, or maize, is the most important crop of the United States. The acreage devoted to it exceeds by about one-tenth that of all the other cereals—wheat, oats, barley, rye, and buckwheat; the number of bushels yielded is nearly twice that of all these other grains; and the value of the crop exceeds that of all of them by about 30 per cent. In 1880 there were 62,368,000 acres of corn, producing 1,754,600,000 bushels, or 28.1 bushels per acre. The value of the crop, at 40 cents per bushel, was $701,840,000, or $11.25 per acre. In 1870 the produce was 760,944,000 bushels—an apparent increase in 1880 of 130 per cent. But 1870 was an exceptionally bad year for corn, the yield for 1871, with little increase of acreage, being 990,000,000 bushels. For purposes of comparison it is safer to take the average yield of the years 1871 to 1879, which was 1,194,512,000 bushels, the increase in 1880 over this average being about 560,000,000 bushels, or 46.9 per cent.

Corn is grown in every State in the Union. Its production is smallest, in proportion to the population, in the New England States. Next in the reverse order of production are the extreme Southern States. Then come the group of Middle States, lying east of Ohio and Michigan and north of Virginia. The chief area of corn-growing is the Western and North-western States. Six States—Illinois, Iowa, Missouri, Indiana, Ohio, and Kansas—produced in 1880 upwards of 1,200,000,000 bushels of corn: more than two-thirds of all that was grown in the United States. It will be seen from Table VI. that these are also the States which contain the largest numbers of swine.

Corn, although used to a considerable extent as human food —more especially in the Southern States—finds its chief use as food for animals. Strictly speaking, it can hardly be considered one of our great bread-stuffs, although warm cakes and puddings made from it take to a considerable extent the place of bread. Corn, as compared with wheat, is deficient in the nitrogenous element, which is however readily supplemented by the use of meat or fats with it. It seems quite within the range of science to devise a mode of making corn "bread," in the proper sense of the term.

As yet, corn does not at all rank with wheat as an article of export; and there is little reason to anticipate that it will do so. But so valuable are its uses, and so comparatively abundant is its yield, except in unfavorable seasons, that there can be no doubt that it will continue to be, if not the most important, yet one of the most important of our cereal crops—one which will be found among those most profitable to the farmer, especially if he be also a stock-raiser.

The corn-crop of 1881 was very deficient, the average yield being only 18.6 bushels per acre—the lowest on record. The crop of 1882, notwithstanding a considerable increase of acreage, is estimated by the Commissioner of Agriculture at about 1,625,000,000 bushels, or 7.4 per cent. less than that of 1880.

Wheat.—Wheat is not known to exist in its native wild state. As a cultivated plant it has been known from the earliest historical ages, and has always formed a large portion of the bread-stuff of all civilized peoples. It is the most perfect of grains, since it contains in itself all the elements required for human food, and in the right proportions. A man may subsist in health upon no other food than brown bread made from unbolted flour, or from "middlings," or "seconds," in which the bran has been removed by the first bolting. But the subsequent boltings by which fine and superfine flour is produced for making "white bread" remove some of the essential elements of the grain. Bread made from this flour will not alone sustain life for any considerable period. Dogs have been fed, by way of experiment, upon white bread only, and they starved to death

TABLE VI.—ACREAGE AND PRODUCT OF GRAIN CROPS, 1880.

States.	Corn.		Wheat.		Oats.	
	Acres.	*Bushels.*	*Acres.*	*Bushels.*	*Acres.*	*Bushels.*
Alabama	2,055,929	25,451,278	264,971	1,529,657	324,628	3,039,639
Arizona	1,818	34,746	9,026	136,427	29	564
Arkansas	1,298,310	24,156,417	204,084	1,269,715	166,513	2,219,822
California	71,781	1,993,325	1,832,429	29,017,707	49,947	1,341,271
Colorado	22,991	455,968	64,693	1,425,014	23,023	640,900
Connecticut	55,796	1,880,421	2,198	38,742	36,691	1,209,706
Dakota	90,852	2,000,864	265,298	2,830,289	78,226	2,217,132
Delaware	202,120	3,894,264	87,539	1,175,272	17,158	378,508
Dist. of Columbia	1,032	29,750	284	6,402	267	7,440
Florida	360,294	3,174,234	81	422	47,962	468,112
Georgia	2,538,733	23,202,018	475,684	3,159,771	612,778	5,548,743
Idaho	569	16,408	22,066	540,589	13,197	462,236
Illinois	9,019,381	325,792,481	3,218,542	51,110,502	1,959,889	63,189,200
Indiana	3,678,420	115,482,300	2,619,695	47,284,853	623,531	15,599,518
Iowa	6,616,144	275,014,247	3,049,288	31,154,205	1,507,577	50,610,591
Kansas	3,417,817	105,729,325	1,861,402	17,324,141	435,859	8,180,385
Kentucky	3,021,176	72,852,263	1,160,108	11,356,113	403,416	4,580,738
Louisiana	742,728	9,889,689	1,501	5,034	26,861	229,840
Maine	30,997	960,633	43,829	665,714	78,785	2,265,575
Maryland	664,928	15,968,533	569,296	8,204,864	101,127	1,794,872
Massachusetts	52,555	1,797,768	963	15,768	20,659	645,159
Michigan	919,656	32,461,452	1,822,749	35,532,543	536,187	18,190,793
Minnesota	438,737	14,831,741	3,044,670	34,601,030	617,469	23,382,158
Mississippi	1,570,550	21,340,800	43,524	218,890	198,497	1,959,620
Missouri	5,588,265	202,414,413	2,074,394	24,966,627	968,473	20,670,958
Montana Ter.	197	5,649	17,765	469,688	24,691	900,915
Nebraska	1,630,660	65,450,135	1,469,865	13,847,207	250,457	6,555,875
Nevada	487	12,891	3,674	69,298	5,937	186,860
New Hampshire	36,612	1,350,248	11,248	169,316	29,485	1,017,620
New Jersey	344,555	11,150,705	149,760	1,901,739	137,422	3,710,573
New Mexico Ter.	41,449	633,786	51,230	706,641	9,237	156,527
New York	779,272	25,690,156	736,611	11,587,766	1,261,171	37,575,506
North Carolina	2,305,419	28,019,839	646,829	3,397,393	500,415	3,838,068
Ohio	3,281,923	111,877,124	2,556,134	46,014,869	910,388	28,664,504
Oregon	5,646	126,862	445,077	7,480,010	151,624	4,385,650
Pennsylvania	1,373,270	45,821,531	1,445,384	19,462,405	1,237,593	33,841,439
Rhode Island	11,893	372,967	17	240	5,575	159,339
South Carolina	1,303,404	11,767,099	170,902	962,358	261,445	2,715,505
Tennessee	2,904,873	62,764,429	1,196,563	7,331,353	468,566	4,722,190
Texas	2,468,587	29,065,172	373,570	2,567,737	238,010	4,893,359
Utah Territory	12,207	163,342	72,542	1,169,199	19,525	418,082
Vermont	55,249	2,014,274	20,748	337,257	99,548	3,742,282
Virginia	1,768,127	29,119,761	901,177	7,826,174	563,443	5,333,181
Washington Ter.	2,117	30,183	81,554	1,921,322	37,962	1,571,706
West Virginia	565,785	14,090,609	393,068	4,201,711	126,931	1,908,505
Wisconsin	1,015,393	34,230,579	1,948,160	24,884,689	955,597	32,905,320
Wyoming Ter.	......	....	241	4,674	822	22,512
Totals	62,368,504	1,754,591,676	35,430,333	459,483,137	16,144,593	407,858,999

in a month. But when white bread is eaten, as it usually is, together with other kinds of food which supply the elements abstracted by bolting, it forms the real staff of life in the United States and in Europe for all who can afford it.

Wheat is grown in every State of the Union; but its growth

TABLE VI. (*continued*).—ACREAGE, ETC., 1880.

STATES.	Barley.		Rye.		Potatoes.	Hay.
	Acres.	*Bushels.*	*Acres.*	*Bushels.*	*Bushels.*	*Tons.*
Alabama	511	5,281	5,764	28,402	334,925	10,363
Arizona	12,404	239,051	......	......	26,249	5,606
Arkansas	157	1,952	3,290	22,387	402,027	23,295
California	586,350	12,463,561	20,281	181,681	4,550,565	1,135,180
Colorado	4,112	107,116	1,294	19,465	383,123	85,062
Connecticut	575	12,286	29,794	370,733	2,584,262	557,860
Dakota	16,156	277,424	2,385	24,359	664,086	308,036
Delaware	19	523	773	5,953	283,864	49,632
District of Columbia	......	......	301	3,704	33,064	3,759
Florida	21	210	601	2,965	20,221	149
Georgia	1,439	18,662	25,854	101,716	249,590	14,409
Idaho	8,291	274,750	354	4,341	157,307	40,053
Illinois	55,267	1,229,523	192,138	3,121,785	10,365,707	3,280,319
Indiana	16,399	382,835	25,400	303,105	6,232,246	1,361,083
Iowa	198,861	4,022,588	102,607	1,518,605	9,962,537	3,613,941
Kansas	23,993	300,273	34,621	413,181	2,894,198	1,589,987
Kentucky	20,080	486,326	89,417	668,050	2,269,890	218,739
Louisiana	......	......	201	1,013	180,115	37,029
Maine	11,106	242,185	2,161	26,398	7,999,625	1,107,788
Maryland	226	6,097	32,405	288,067	1,497,017	264,468
Massachusetts	3,171	80,128	21,666	213,716	3,070,389	684,679
Michigan	54,506	1,204,316	22,815	294,918	10,924,111	1,393,888
Minnesota	116,020	2,972,965	13,614	215,245	5,184,676	1,636,912
Mississippi	44	348	806	5,134	303,821	8,894
Missouri	6,472	123,031	46,484	535,426	4,189,694	1,077,458
Montana Territory	1,323	39,970	15	430	228,702	63,947
Nebraska	115,201	1,744,686	34,297	424,348	2,150,893	785,433
Nevada	19,399	513,470	......	......	302,143	95,853
New Hampshire	3,461	77,877	3,218	34,638	3,358,828	583,069
New Jersey	240	4,091	106,025	949,064	3,563,793	518,990
New Mexico Territory	2,548	50,053	17	240	21,883	7,650
New York	356,629	7,792,062	244,923	2,634,690	33,644,807	5,240,563
North Carolina	230	2,421	61,953	285,160	722,773	93,711
Ohio	57,482	1,707,129	29,499	389,221	12,719,215	2,210,923
Oregon	29,311	920,977	841	13,305	1,359,930	266,187
Pennsylvania	23,592	438,100	398,465	3,683,621	16,284,819	2,811,654
Rhode Island	715	17,783	1,270	12,997	606,793	79,328
South Carolina	1,162	16,257	7,152	27,049	144,942	2,706
Tennessee	2,600	30,019	32,493	156,419	1,354,481	186,698
Texas	5,527	72,786	3,326	25,399	228,832	59,699
Utah Territory	11,268	217,140	1,153	9,605	573,595	92,735
Vermont	10,552	267,625	6,319	71,733	4,438,172	1,051,183
Virginia	859	14,223	48,746	324,431	2,016,766	287,255
Washington Territory	14,680	566,537	518	7,124	1,035,177	106,819
West Virginia	424	9,740	17,279	113,181	1,398,539	232,338
Wisconsin	204,335	5,043,118	169,692	2,298,513	8,509,161	1,896,969
Wyoming Territory	......	......	6	78	30,986	23,413
Totals	1,997,727	43,997,495	1,842,233	19,831,595	169,458,539	35,205,712

has since 1850 fallen off in all the New England States except Maine. These six States produced in 1880 only 1,125,000 bushels. There are single counties in all of the great wheat-growing States each of which produce more — some of them twice as much—wheat as all New England. In some of the wheat-growing States the production remains nearly stationary, or has declined relatively to the population, for several decades. In 1850 New York was a great wheat-growing State, producing 13,100,000 bushels; in 1860 the production fell to 8,700,000 bushels; in 1870 it rose to 12,200,000 bushels, and in 1880 declined to 11,600,000 bushels. In Pennsylvania the production in 1850 was 15,400,000 bushels; in 1860, 13,000,000; in 1870, 19,700,000; in 1880, 19,500,000. In New Jersey the product in 1850 was 1,600,000 bushels; in 1860, 1,700,000; in 1870, 2,300,000; in 1880, 1,900,000. In Maryland the production in 1850 was 4,500,000 bushels; in 1860, 6,100,000; in 1870, 5,800,000; in 1880, 8,000,000. In Virginia (including what is now West Virginia) the production in 1850 was 11,200,000 bushels; in 1860, 13,100,000; in 1870, 9,900,000; in 1880, 11,800,000. In North Carolina the production in 1850 was 2,100,000; in 1860, 4,700,000; in 1870, 2,900,000; in 1880, 3,400,000.

Previous to 1850 these seven States constituted almost the entire wheat-growing section of the country. During the thirty succeeding years their absolute production of wheat has varied very slightly, while their population has increased about 70 per cent. In 1850 Ohio, Illinois, Indiana, and Michigan were just coming into importance as wheat-growing States. In 1880 Illinois alone produced seven-eighths as much wheat as all these seven Central Atlantic States and New England together; Indiana and Ohio each about four-fifths as much; Michigan and Minnesota each about five-eighths as much; California and Iowa each about half as much.

This great falling off, in all of the Atlantic States, in the production of wheat as compared with the increase of population shows that wheat-growing in those States is not, except under special circumstances, a profitable business—at least, does

SOWING AND REAPING IN DAKOTA.

See Note 2.

not furnish as profitable use for the land as is furnished by other crops. In some sections the decline is to be attributed to the soil or climate not being adapted to the growth of the grain. In others the great cause has been injudicious farming. The soil has been exhausted by repeated crops, without supplying the missing elements by means of fertilizers. Thus, in some parts of Central New York, where fifty years ago thirty or forty bushels per acre were expected, the crop gradually fell off to seven or eight bushels, and the cultivation of wheat was given up—the farmers taking up other crops, or moving to the West, where there were fresh lands: to be, in not a few cases, subjected to the same ruinous mode of farming. Such soils can be restored to their original fertility by judicious farming and by the use of fertilizers. If one has land in these States which has not been exhausted, or which may be restored, he may find wheat-growing a profitable business; but hardly if he has not such land.

In 1880 the area of wheat-growing was 35,430,333 acres; the yield was 459,483,137 bushels, or 13 bushels per acre. The value of the crop, at $1.05 per bushel (the average for the preceding ten years), was $482,457,293, or upon an average $13.65 per acre. In 1870 the production was 287,745,626 bushels—an increase in 1880 of 59.7 per cent.

The yield of wheat varies very greatly in different sections of the country. In 1880 the average yield in Michigan was 19.1 bushels per acre; in Indiana and Ohio, 18 bushels; in Illinois, California, and New York, 15.8 bushels; in Minnesota and Pennsylvania, 13.5 bushels; in Missouri, Iowa, West Virginia, and Kentucky, 10 bushels; in Kansas and Nebraska, 9.2 bushels; in Texas, 7 bushels; in Georgia, 6.5 bushels; in Tennessee, 6 bushels. The yield in the States where it is the greatest is far below what is attained in countries where the soil and climate are less favorable to the plant. The average yield in England in good seasons is 33 bushels to the acre; in Denmark, 27 bushels. Numerous instances are given in which upon fields of considerable extent in various sections of the United States the yield was very much larger than this. These results have been attained only by very high tillage, and perhaps a more free use of fertilizers than would at present be found profitable by the majority of farmers. But as the price of wheat-land advances, more and more costly and careful tillage must be resorted to. In the judgment of the best authorities the average yield per acre of wheat throughout the country might now be increased from twenty to fifty per cent., without anything like a corresponding increase in the cost to the produce.

The year 1881 was an unfavorable one for wheat as well as for corn. The yield of 1882 was good, and there was a large increase of acreage. The Commissioner of Agriculture estimates the crop at about 503,000,000 bushels—an increase in 1882 over 1880 of 9.3 per cent. Of this it is estimated that 250,000,000 bushels would be required for home consumption, 57,000,000 for seed, leaving nearly 200,000,000 bushels for exportation. In several of the great wheat-growing States there was a sensible decrease of the yield from that of 1880. Kansas increased from 17,000,000 bushels to 33,000,000; Oregon, from 7,500,000 to 12,000,000; California, from 29,000,000 to 34,500,000; South Carolina, from 960,000 to 1,730,000.

Oats.—Next in importance after corn and wheat come oats. With us they are used as human food only to a very limited extent, their main use being as food for live-stock—more especially of horses. Oats are grown in every State of the Union, and in considerable quantities in several. But the nine States of Illinois, Iowa, New York, Pennsylvania, Wisconsin, Ohio, Minnesota, Missouri, and Michigan produce three-fourths of all the oats grown in the United States.

In 1880 there were 16,144,593 acres devoted to oats, yielding 407,858,899 bushels, or 24.6 bushels to the acre. The value of the crop, at 34.5 cents per bushel (the average of the preceding ten years), was $140,711,320, or $8.40 per acre. The production in 1870 was 282,107,157 bushels, being an increase in 1880 of 44.6 per cent.

The real value of the oat, however, is considerably greater than appears from the foregoing figures, in which account is taken only of the grain itself, for the straw makes excellent fodder. Moreover, it is a hardy plant, will thrive on almost any soil which is not too wet, is liable to few diseases and insect enemies, exhausts the soil less than most other crops, and so requires comparatively little manuring. Upon the whole, oats may be considered a very safe and reliable crop.

Both 1881 and 1882 were unusually good years for oats. The Commissioner of Agriculture estimates the crop of 1882 at about 476,000,000 bushels—an increase over that of 1880 of 17 per cent. The acreage sown was also very considerably increased. The great yield of oats in 1881 went far to supply the deficiency in the corn crop of that year.

Barley.—Throughout the most of Northern and Central Europe barley and rye constitute the chief bread-stuffs of the peasantry. From these is made the black bread which they mostly eat, wheat bread being almost unknown to them. With us barley is scarcely used at all for food, but almost wholly for the production of malt, to be used in brewing. It is grown somewhat in every part of the Union, but is an important crop only in California, New York, Wisconsin, Minnesota, and Iowa, which produce three-fourths of the whole crop. In 1880 there were 1,997,727 acres devoted to barley, producing 43,997,495 bushels. The value of the crop, at 73 cents per bushel (the average of the preceding ten years), was $32,118,171, or $16.10 per acre. The production in 1870 was 29,761,305 bushels—an increase in 1880 of 47.8 per cent.

Rye.—Rye, as well as barley, is largely used as a bread-stuff by the peasantry of Northern and Central Europe. It was formerly considerably used, mixed with corn-meal, for bread in some of the United States. But its main use is for distilling. Pennsylvania, Illinois, New York, and Wisconsin produce two-thirds of all the rye grown in the United States. There were, in 1880, 1,842,233 acres devoted to rye, producing 19,831,595 bushels, or 10.8 bushels per acre. The value of the crop, at 69 cents per bushel (the average of the preceding ten years), was $13,683,800, or $7.51 per acre. The production of 1870 was 16,918,795 bushels, an increase in 1880 of 17.2 per cent. But the production in 1850 was nearly as great, and in 1860 considerably greater, than in 1880; so that, relatively to the population, the cultivation of rye has steadily fallen off during the last thirty years. In respect to the value of the crop per acre, it stands lowest of all our cereals.

Buckwheat is grown in small quantities in all except the Southern States; but more than two-thirds of the whole crop is produced in New York and Pennsylvania. There were, in 1880, 848,389 acres of buckwheat, producing 11,817,327 bushels, or 14 bushels per acre. The value of the crop, at 70 cents per bushel, was $8,272,128, or $9.80 per acre. The production, in 1870, was 9,821,721 bushels, an increase in 1880 of 20 per cent. But the production in 1860 exceeded that of 1880 by about 33 per cent. Buckwheat has never come to be at all a staple crop, its chief recommendation being that it will grow where nothing else will.

Rice can hardly be reckoned among the cereal grains of the United States, its production being practically limited to Georgia, Louisiana, and South Carolina, the last State producing about one-half of the entire crop. Its cultivation can be carried on successfully only in low, swampy lands which can be overflowed at pleasure. In 1880 there were 174,173 acres of rice-fields, producing 110,131,373 pounds, the value of which, at five cents per pound, was $5,506,558, or $32 per acre. The rice-swamps are exceedingly unhealthy for white persons. In no case can the cultivation of rice be greatly extended in the United States, as the area adapted for the growth of the plant is very limited.

Root Plants.

Apart from bread-stuffs the potato (improperly called the Irish potato) and the sweet-potato constitute the principal vegetable food of the people of the United States. Table VI. shows for each State the acreage and yield of these plants.

The Potato.—Although potatoes are grown to some extent in every State of the Union, their cultivation is mainly confined to Virginia and the States lying north of it. In the Southern States their place is taken by the sweet-potato; in Virginia itself the production of the two species is about equal. The acreage devoted to potatoes in 1880 is given in the Census for only the sixteen States where they form an important crop. In these States there were in 1880 about 1,170,000 acres, producing 107,800,000 bushels, or 90 bushels per acre. The entire product of 1880 was 169,458,539 bushels. The value of the crop, at 55 cents per bushel (the average of the ten preceding years), was $93,202,196, or $49.50 per acre, being more than for any other farm crop. In 1870 the product was 143,337,473 bushels, an increase in 1880 of 18.2 per cent.

Potatoes are, however, a more uncertain crop than almost any other, and, as they cannot well be kept over from one year to the next, their market value is regulated to a great extent by the amount of their production in that year. Thus in 1871 the yield was 98 bushels per acre, price per bushel $0.59; in 1872, yield 85 bushels, price $0.60; in 1873, yield 90 bushels, price $0.70; in 1874, yield 81 bushels, price $0.68; in 1875, yield 110 bushels, price $0.40; in 1876, yield 71 bushels, price $0.67; in 1877, yield 95 bushels, price $0.45; in 1878, yield 70 bushels, price $0.59; in 1879, yield 99 bushels, price $0.44. The average value of the crop per acre during these nine years was about $48.

To offset this high average value per acre of the potato crop it must be borne in mind that the cultivation and harvesting of a bushel of potatoes involves more labor than for a bushel of any of the grain crops, although the quite recent introduction of the "potato-planter" and the "potato-digger," drawn by horses, greatly reduces the work upon large fields. As a product of the garden or of comparatively small fields in the vicinity of cities or large towns, where the highest culture can be profitably employed, the potato is one of the most profitable crops which can be raised. The market-gardener will, of course, select the varieties which produce the best fruit, and will make free use of manures and fertilizers. The very best tubers should be picked out for seed, since they are worth for that purpose far more than their market value.

The Sweet-potato.—The sweet-potato is largely and profitably cultivated in New Jersey, for the supply of the great markets of New York and Philadelphia. Elsewhere its production is almost wholly confined to Virginia and the more southern States, where it takes the place of the potato. Since 1850, however, its cultivation has greatly decreased absolutely, and still more largely relatively, to the increase of population. In 1850 the production was 38,000,000 bushels, exceeding that of 1880 by 18 per cent. The production reached its highest point in 1860, when it was 42,000,000 bushels, exceeding that of 1880 by 27 per cent. In 1870 it fell off to a little more than 21,000,000 bushels—only half as much as was produced in 1850. In 1880 the product was 33,378,693 bushels, an increase in 1880 over 1870 of 54 per cent. This large recent increase, after a period of decrease, shows that this branch of agricultural industry has grown profitable. The increase is general, and pretty nearly uniform in all of the ten States where the sweet-potato is mainly grown, Texas alone showing a decrease. There are no statistics accessible for the acreage of the sweet-potato or the value of the crop. It is mainly raised for home consumption, except in those sections which have ready access to the Northern markets. In these sections, especially in New Jersey and the seaboard of Virginia, the Carolinas, and Georgia, there can be no doubt that this crop holds out high inducements for the cultivator.

Other Root Crops.—The various species of turnips are largely grown in Europe as food for cattle and for the oil extracted from their seeds. Beets are also largely cultivated there for the production of sugar. Both of these are with us raised to a considerable extent as food for cattle, especially for milch cows; but they are mainly products of the garden rather than of the farm. So, also, are carrots, parsnips, radishes, onions, and other tubers. No data are given in the Census Report to enable us to estimate the acreage, quantity, or value of any of these products; but it is certain that their cultivation is a lucrative industry, and is capable of being made more so wherever there is a market for garden products. A few acres near a city or large town may be made to afford more net profit than a considerable farm in the strictly agricultural regions.

Sugar.

In tropical climates much sugar is produced from the sap of various species of the palm; with us, from the sap of the maple. In France, Germany, and other parts of Europe, very large quantities are made from the juice of the beet. But by far the greatest part of the sugar of the world comes from the juice of the sugar-cane. Some years ago it was estimated that the entire consumption of sugar in the world was 3,500,000,000 pounds—of which 66.47 per cent. was cane-sugar; beet-sugar was 27.87 per cent.; palm-sugar, 4.29 per cent.; maple-sugar, 1.28 per cent.

CANE-SUGAR.—About one-third of the cane-sugar of the world is produced in Cuba, nearly another third in the other West India Islands and in the French colonies. In the United States its production is limited to a very small territorial area, mostly comprised in the eight southern "parishes" of Louisiana, lying west of the Mississippi and upon the Gulf of Mexico. Few of the remaining fifty parishes produce sugar to any considerable amount. There were, in all, in 1880, 227,776 acres devoted to the sugar-cane, producing 178,872 hogsheads of sugar, and 16,573,273 gallons of molasses. Of this, 181,592 acres—producing 171,706 hogsheads of sugar, and 11,696,248 gallons of molasses—were in Louisiana. The average product per acre of the sugar-cane is estimated at about $100. But the climate even of Southern Louisiana is not among the best for the cane, and its cultivation is made profitable only by reason of the heavy duty laid upon foreign sugar and molasses. Sugar is about our only agricultural product which is "protected" by a tariff. If the duty were removed the cultivation of the cane here would cease. The production of cane-sugar cannot be successfully prosecuted anywhere except upon a large scale, and by means of costly machinery; and its area of culture in the United States cannot be much extended. The amount raised here forms but a small fraction of that required for consumption. The greater part of our sugar is imported "raw," and is "refined" in New York and other cities. "Sugar-refining" is a very important industry, but it belongs to the department of Manufactures—not to that of Farming.

The growing of the sugar-cane in the United States has declined since 1850. In that year there were produced 247,577 hogsheads of sugar and 12,700,000 gallons of molasses, the sugar product exceeding that of 1880 by 39 per cent. In 1860 the product of sugar was 230,982 hogsheads, exceeding that of 1880 by 33 per cent. The civil war put an almost total stop to the production of sugar in the South. It began to revive upon the restoration of peace, but the product in 1870 was only 87,043 hogsheads—less than one-fourth of what it was in 1850, although the less important article of molasses had increased. The revival went on from 1870 to 1880, and just about doubled, but still falling very far below what it had reached thirty years before; and there is no probability of any considerable increase hereafter. It is more than probable (as is shown below) that sugar from sorghum will at no distant date supersede that from the cane to a very great extent.

Maple-sugar.—Up to about 1850, when means of transport were comparatively scanty and money scarce, maple-sugar was a considerable product in sections where the tree was abundant, especially in New York, Vermont, Ohio, Michigan, Illinois, and Indiana. In 1850 the product was 34,000,000 pounds of sugar and 13,000,000 gallons of molasses; in 1860 there were produced 40,000,000 pounds of sugar and 1,600,000 gallons of molasses; in 1870 there were 28,000,000 pounds of sugar and 1,000,000 gallons of molasses. Thus, relatively to the increase of population, the product of maple-sugar in 1870 was 44 per cent. less than in 1860. This decrease is owing partly to the comparative cheapness of imported cane-sugar, and partly to the rapid cutting down of the trees for fuel and lumber. In 1880 maple-sugar did not appear in the Census Report among farm products. It has come to be among the delicacies rather than the necessities of life, its peculiar flavor rendering it a favorite accompaniment for certain articles of food. Its manufacture must be confined to a few weeks in the year in which the farmer has comparatively little to do, and so it really costs him little or nothing. The amount which can be produced must of necessity diminish with the decrease of the forests, and all that can be made will be sure of a ready sale. Any one who has a number of the trees will find maple-sugar a profitable product.

SORGHUM-SUGAR.—The sorghum-plant, sometimes called "Chinese sugar-cane," has long been used in China for the production of sugar. Seeds of the plant were first brought to Europe in 1851. In 1854 small quantities of the seed were brought to the United States and distributed among cultivators in various sections. The plant was found to flourish on appropriate soils from Maine to Texas. Its cultivation spread rapidly, especially in Illinois, Indiana, Kentucky, Missouri, Ohio, and Tennessee, mainly for the sake of the molasses made from its juice, although the leaves form an excellent food for cattle—100 pounds of the green leaves being for that purpose equal to 75 or 80 pounds of hay.

Until quite recently sorghum-juice was almost wholly converted into molasses. The Census of 1870 reports only 24 hogsheads of sorghum-sugar, while there were 16,000,000 gallons of molasses—two and a half times as much as there were of cane-molasses in that year, and seven per cent. more than there were of cane-molasses in 1860. The Census Report of 1880 makes no mention of sorghum, and the production apparently fell off between 1870 and 1880. The molasses usually had a somewhat unpleasant, earthy flavor, although that which was skilfully prepared was not inferior to the best cane-molasses. But the efforts to crystallize the sirup were only moderately successful, either in respect to the quantity or the quality of the sugar produced. But since 1880 great improvements have been introduced, by which sugar equal to any other can be produced from sorghum at a cost much less than that of producing cane-sugar in Louisiana; and there can be no doubt that the cultivation of sorghum must soon rank very high among our great agricultural industries. The area where the sugar-cane will grow in the United States is very limited, while it may be said in general terms that the area of sorghum is co-extensive with that of Indian-corn—perhaps not extending quite so far northward, but reaching a little farther southward. To produce sugar from the cane requires powerful and costly machinery to crush the tough stalks; sorghum can be crushed much more easily. Cane-sugar can be produced at a profit only upon large plantations; sorghum-sugar can be made upon a scale not beyond the reach of an ordinary farmer. Probably, however, it will ultimately be found more advantageous for the farmer to sell his stalks to the sorghum-mills.

Beet-sugar.—The production of sugar upon a large scale from the more saccharine species of beets was set on foot in France about 1811, during the Napoleonic wars, when the ports of Continental Europe were so closely blockaded by the British that cane-sugar could not be had from the West Indies. The production spread into Germany, Austria, and Russia, where it is still an important industry. Various attempts have been made to introduce its manufacture into Great Britain and the United States, but none of these have met with satisfactory results. Apart from the comparatively small amount of saccharine matter, the juice of the beet is highly charged with impurities, which must be removed before the sugar is merchantable. There is no likelihood that the production of beet-sugar will ever become profitable in the United States.

Corn-sugar, Starch-sugar, or Glucose.—This, though an artificial production, is chemically so much like cane-sugar that the two were long considered by chemists to be the same. Glucose is made by boiling starch of any kind in a weak dilution of sulphuric acid, then neutralizing the acid by means of lime. Glucose, until quite recently, was mainly used in Europe for wine-making and brewing, in order to produce, by fermentation, a larger amount of alcohol, and was known as "grape-sugar," although made mainly from potato-starch. Within a year or two glucose has come to be largely made from the starch of corn. Besides its use in brewing—a hundred pounds of it being sometimes added to three hundred pounds of malt—glucose is used in making confectionery. It was formerly produced almost wholly in the form of a thick sirup; but means have been found to treat the sirup so that the crystallized glucose can hardly be distinguished from cane-sugar, except by its deficiency in sweetness. It is said to be considerably used for adulterating cane-sugar, as it can be produced for about half the price per pound. There is no reason to suppose that the mixture is deleterious to health; but one pound of sugar will sweeten as much water as two, three, or four pounds of glucose; the purchaser of the mixture, therefore, pays just in that proportion for an article which for household purposes is practically useless, whatever may be its advantages to the brewer. Reputable sugar-refiners affirm—and probably truly—that they do not themselves use glucose at all. The adulteration is probably made by the retailer. The ordinary purchaser can detect it only by discovering that it takes much more sugar than formerly to sweeten his cup of tea or coffee. The residue of the corn, after the starch has been extracted, forms an excellent food for cattle. The manufacture of glucose from corn can be profitably conducted only upon a large scale.

Hay and Fodder.

HAY.—Hay certainly ranks as the fourth—perhaps as the third—in value among the farm products of the United States. The average value of the four principal crops for the nine years 1871–1879 was: Indian-corn, $495,000,000; wheat, $336,000,000; hay, $322,000,000; cotton, $270,000,000. Hay is used almost wholly as food for cattle, horses, mules, and sheep, and especially for their winter fodder. It is, therefore, most largely required in those sections where the winters are long and severe, although it is grown more or less in every State of the Union. Table VI. shows the quantity produced in 1880 in each State. The entire product in 1880 was 35,205,712 tons; in 1870 it was 27,316,048 tons, an increase in 1880 of 29 per cent., the ratio of increase being only 1 per cent. less than that of the increase of population. The acreage of hay is not given in the Census Report; the most authentic estimates place it approximately at about 28,000,000 acres in 1880. The average price per ton for ten years was $11.50; average yield, 1.23 tons per acre; value of crop per acre, $14.04—considerably exceeding that of corn, wheat, or oats.

As hay is a bulky crop in comparison with its value, the greater part of the yield is consumed near where it is grown, even that required for horses in large cities not being usually brought from any great distance. The quantity of hay required for wintering stock is an important element in estimating the profitableness of raising and keeping live-stock. In the great stock-raising States of Texas, California, and Colorado, stock live through the winter almost without hay; in the New England States each head of live-stock consumed, upon an average, 2.40 tons of hay per year; in New York and Pennsylvania each head eats 1.78 tons; in the group of States represented by Illinois and Ohio the average per head is 0.89 ton; in the group represented by Virginia and Tennessee, 0.24 ton; while in Texas each head consumed only a small fraction of a ton, and the cost of fodder for wintering a large herd is scarcely appreciable.

Taken in connection with the raising of live-stock — and almost every farmer is to a greater or less extent a stock-raiser — the hay crop is of even more real importance than its own great value indicates. At the North, indeed, it has long been held to lie at the basis of all successful farming. If we take into the same view the different kinds of green fodder, this statement will be accepted as a just one. Even in those sections where stock can actually forage for themselves it would, doubtless, be wise economy to provide them with fodder during the winter.

Great attention has been paid by all successful farmers to selecting the kinds of grass best adapted to the varieties of soil and climate. Timothy, red-top, and blue-grass are conceded to be among the best varieties. Clovers are also of great value to the farmer for hay, and in other respects. The lucern, a species of clover, known also by its Spanish name, "alfalfa," flourishes most luxuriantly in California, wherever it can have water enough. It does not appear to be a safe crop in the more northern States, but, in the opinion of competent judges, it is the best of all its congeners for a great part of the South, whether cured as hay or given as a green fodder. Various species of millet are worthy the attention of the farmer as future fodder-plants.

Green Fodder.—Turnips, beets, and the like are much less used as animal food among us than in Europe. It is certainly worth careful experiment to determine whether the use of them, especially for milch-cows, could not be profitably carried much farther than it is. The process known as *ensilage*, or "pitting," is highly recommended, as at least a partial substitute for the drying and curing operations which constitute hay-making. The grass, as soon as possible after cutting, is packed into pits, where it is pressed down by heavy weights. The access of air being prevented by this close packing, fermentation does not ensue. The green corn-stalks, after being cut into small pieces by a machine, are treated in the same way. The advocates of this comparatively new process claim that the ensilage fodder is far better than hay. Not improbably both would be better than either. Setting aside the relative value of the two kinds of food, the relative cost of preparing it still needs to be definitely determined.

Textile Products of the Farm.

Wool is strictly a farm product; but, as it is also an animal product, it is considered in the subsequent chapter upon "Live-stock." The quantity produced in the several States is, however, embodied with other farm products in Table VI.

Cotton is not only by far the most important of American textile products, but is the most important one in the world. Fully one-half of the human race are clothed almost exclusively in cotton, and cotton fabrics enter largely into the clothing of a great majority of the remainder. Cotton sufficient for the enormous home consumption is grown in India, but its fibre is too short to be wrought up by our present machinery, unless largely mixed with the American product; comparatively little is exported from India, and for all commercial purposes the United States are, and will probably continue to be, the chief producers of the staple. Two-thirds of our yield is exported, and the price is regulated mainly by that in foreign markets, especially by those of Great Britain.

Cotton is grown to some extent in thirteen States of the Union, and is an important product in nine of them; but nearly two-thirds of the whole is grown in Texas, Georgia, Mississippi, and Alabama. The product of cotton is usually measured by "bales." Up to 1870 a bale was reckoned at 400 pounds. Since then the bales have been made heavier, 450 pounds being the average.

In 1880 there were 14,480,619 acres devoted to cotton, producing 5,755,359 bales of 450 pounds, or about 190 pounds to the acre. In 1860 the product (in bales of 450 pounds) was 4,788,000 bales. The civil war put an almost entire stop to cotton-planting, and it was several years before it fairly began to revive; so that the product in 1870 was only about 2,675,000 bales (of 450 pounds), the increase of the abundant year, 1880, over the poor year, 1870, being 115 per cent., and about 20 per cent. above the great product of 1860. There was, according to the Report of the Commissioner of Agriculture, an increase in 1881 of about 10 per cent. over the preceding year. In 1882 there was a decline of two or three per cent. from 1881, owing in part to the overflow of the Mississippi. The Report for 1882 gives the area of cotton-growing as 16,276,691 acres, and the product as 3,052,837,946 pounds (6,784,084 bales), averaging 187 pounds to the acre. In three States the product was considerably larger per acre. In Arkansas it was 233 pounds; in Louisiana, 235 pounds; in Texas (which produced nearly one-fourth of the whole crop) it was 240 pounds per acre.

The price for cotton has for several years been low, showing that the present production is fully up to the demand. It has not averaged more than 8 cents per pound, making the average product per acre about $15; while the cost of growing, and especially of "picking" the "wool" is greater than with most other crops. The seed, however, is of considerable value for the oil which it furnishes, and as food for cattle when ground. Still, there is, among planters — so says a very recent Texan writer—"a prevailing conviction that cotton had become comparatively too prominent for the highest profit in the distribution of crop areas. While this conviction appears to be general among intelligent growers, the old habit of too extensive cotton-growing has been too strong to effect much reduction."

Taking all things into consideration, it does not appear that cotton-growing is likely, for some years to come, to present strong inducements for any person to enter upon it who is not already engaged in it. The entire cotton crop would probably bring as much if the production were very much reduced, while a portion of the labor and capital engaged in it would meet with a better reward if otherwise employed. These opinions apply especially to the older and more densely settled of the cotton States. In Texas the cultivation of cotton will undoubtedly be much extended.

Flax.—In 1850 the production of flax in the United States was 7,709,676 pounds. In 1860 it had fallen to 4,720,000 pounds. In 1870 it rose to 27,133,034 pounds. This almost sixfold increase from 1860 to 1870 was owing to the "cotton-famine" occasioned by the civil war; and unsuccessful attempts were made to prepare the flax fibre so that it could be worked up by the ordinary cotton machinery. But when the cultivation of cotton was resumed, after peace was established, that of flax, for its fibre, was practically abandoned, and it does not appear in the Census of 1880 among farm products. There is little or no linen cloth woven in the United States, the supply being imported. Some flax is, however, grown for its fibre, for making thread and twine, since the Census of 1880 reports 1894 "flax-dressers."

Flax is with us now grown principally for its seed, and especially for the oil expressed from it. Linseed-oil, on account of its "drying" property, is the usual vehicle for colors in painting. The seed is also used in pharmacy for poultices, for which it is specially adapted by its long retention of heat and moisture. The residue of the seed, after the oil has been extracted, is valuable as food for cattle. In 1870 there were produced 1,730,444 bushels of flax-seed; but the supply is insufficient for the demand, and large quantities are imported, especially from India. That there is such importation shows that its production here is not profitable. The cultivation of flax, either for the fibre or the seed, is, therefore, not a promising industry.

Hemp is a plant belonging to the nettle family, producing a fibre similar to that of flax, but coarser and stronger, and especially adapted for cordage. In 1870, 12,746 tons of hemp were produced, seven-eighths being in Kentucky. In 1860 the product was 74,493 tons—nearly six times as much as in 1870. It does not appear at all in the Census of 1880. The experience of the last thirty years shows that its cultivation is not profitable. There is a large demand for it, but it can be imported more cheaply than it can be grown here. Of the little that is produced, more than half is grown in Kentucky, and there is no apparent inducement to extend its cultivation.

Ramie is a plant belonging to the same family as hemp, but having a finer and stronger fibre. This is contained in the inner bark, which in Eastern countries is stripped from the stems, cleansed from useless matter, dried and bleached, and then picked by the fingers into filaments of any required fineness. The plant is sometimes called "China-grass." The so-called "grass-cloth" of China is made from this material, and is often of extreme fineness. The fibre can be bleached perfectly white, and then takes dyes as readily and permanently as silk does. Considerable quantities are imported into France and England, to be mixed with silk. A species of the plant grows wild in the United States and in Canada, but its fibre is not very valuable.

In 1857 a plant of the Chinese ramie was sent to the Botanic Garden, in Washington, but no serious attempt was made to cultivate the plant for several years. But in 1867 a *furore* for it was excited in some quarters. Incredible stories were told of its productiveness. It was said that little labor was required for its cultivation, that it produced three crops a year, yielding in all 1500 pounds per acre of the prepared fibre. Large quantities of the bark were prepared and sent to market. But there were no known means of separating it into the fine filaments, except the slow hand process employed in China, where the cost of manual labor is merely nominal, but would here render the prepared fibre more expensive than silk.

The cultivation of ramie was soon abandoned, but there is

A HARVEST SCENE IN SCOTLAND.

See Note 2.

good reason to believe that it may be resumed under happier auspices. The great value of the fibre, and the abundance in which it can be produced, are well established. The one thing wanted is, some machine for separating the bark into its fine, ultimate filaments. It would seem that such an invention is not impossible. The man who shall invent such a machine will do for this new plant what Whitney did for cotton by the cotton-gin. Even as things are, it is suggested that the Chinese hand-process might be employed by us to some extent, as an auxiliary domestic industry for women and children. It is one that might be taken up or laid aside at any spare moment, and thus, whatever should be the value of the fibre, it would be so much clear profit.

Miscellaneous Farm Products.

TOBACCO is grown more or less in nearly every State and Territory, but in several of them in very small quantities. In ten States it is an important industry, each of them producing more than 10,000,000 pounds a year. In 1880 there were 638,841 acres devoted to tobacco, producing 472,661,157 pounds. Of this 36 per cent. was grown in Kentucky; 17 per cent. in Virginia; and 33 per cent. in Pennsylvania, North Carolina, Tennessee, and Ohio. The product in 1870 was 262,735,341 pounds — an increase in 1880 of 80 per cent. But tobacco-growing was seriously diminished by the civil war, the product in 1860 being 434,209,461 pounds; so that the increase in 1880 over 1860 was only 9 per cent., the increase of population in that time being 61 per cent. The cultivation of tobacco is, therefore, relatively a declining industry.

The average yield of tobacco in 1880 was 756 pounds per acre; average price, 8 cents per pound; value of the entire crop, $37,812,902; value of product per acre, $60.80 — considerably more than most others of our great products. But its cultivation and preparation for market involves more labor than almost any other product, and it is, of all crops, the most exhausting to the soil. Everything is taken from the land, and nothing is returned to it. A very few crops of tobacco will "wear out" any field, unless there be an abundant supply of manures and fertilizers. The yield is, moreover, uncertain. Tobacco-growing is, for these reasons, a very unpromising industry.

Hops.—In 1860 there were about 11,000,000 pounds of hops produced in the United States; in 1870 there were 25,456,669 pounds, the plant being grown in almost every State, the increase being nearly 130 per cent. In 1880 there were 46,800 acres of hops, the product being 26,546,378 pounds, an increase of only 4 per cent. over the product of 1870. The cultivation was, moreover, practically abandoned everywhere except in Wisconsin, California, and New York; and Wisconsin produced less than half as much as in 1870. California, however, more than doubled the product of 1870, and in New York the increase was nearly 24 per cent. New York in 1880 produced fully 80 per cent. of all the hops grown; and the cultivation was mainly confined to five of the sixty counties of the State. These five central counties, and two or three counties of California, are the only districts in which hop-growing has proved at all profitable for several years.

Pease and Beans.—These leguminous products are very largely grown in England and some other parts of Europe, as green fodder for cattle, and dried for human food. Their production is much less than formerly. In 1860 there were 15,000,000 bushels; in 1870 only 5,750,000 bushels; and they are not enumerated in the Census of 1880. The Pea-nut, or ground-nut, may be profitably cultivated from Virginia southward. Its pods have the singular habit of burying themselves in the ground and ripening there, and are dug up, like potatoes. The seeds (improperly called "nuts") yield about 20 per cent. of an oil valuable for all purposes for which oils are used, except for painting. Large quantities of the nut are imported into France from Africa for the sake of the oil, which is used for burning, for soap-making, as a lubricant, and for adulterating olive-oil.

Root-Crops.—In Europe various species of the beet and turnip are very important farm products, especially for feeding cattle. The sugar-beet furnishes a very considerable part of the sugar used upon the Continent; but for this purpose it is not probable that it will ever be grown in the United States. In the judgment of many whose opinion is of high authority the cultivation of the beet and turnip for the feeding of cattle may be profitably extended much more widely than it is in this country. But at present the beet, turnip, onion, and other bulbous plants belong rather to the garden than to the farm. They are treated of in the next chapter.

CHAPTER VII.

PRODUCTS OF THE GARDEN.

NO very definite line can be drawn to distinguish a garden from a farm. A garden is, indeed, a miniature farm; but it will be convenient to consider any comparatively small piece of land devoted to the growth of vegetables as a garden. Every farm should, of course, have a kitchen-garden attached to it for the supply of vegetables and small fruits for home consumption.

The successive censuses are, unfortunately—perhaps necessarily—very meagre in details regarding garden products. No attempt has been made to estimate the acreage of gardens. According to the Census Report of 1850, the value of market-garden products was $5,200,000; in 1860 it was $16,200,000. In 1870 it was (in gold) $16,700,000—a relative decrease of about 20 per cent. as compared with the increase of the population from 1860 to 1870. This decrease occurred, however, mainly in the Southern and Border States, and was owing directly to the civil war. In the rest of the Union the ratio of increase in market-garden products was quite equal to that of the increase of population. The Census Report of 1880 puts down 51,482 persons as "gardeners, nurserymen, and vine-growers;" but the value of the products of the garden and vineyard are not separately mentioned, being apparently included among "farm products."

Gardening and its products may be conveniently divided into *Horticulture* (the culture of vegetables, berries, and the small fruits) and *Floriculture* (the culture of flowers). The cultivation of the large fruits is treated in the chapter on "Orchard Products."

Horticulture.

VEGETABLES.—In the vicinity of a city, large town, or even of a manufacturing village, the growing of vegetables may be made highly profitable, and will repay the most careful cultivation. An acre or two favorably situated may be made to afford more net profit to the cultivator than a considerable farm elsewhere. Even if the soil be naturally unproductive, it can be brought to and maintained in a high state of fertility by the use of manures and fertilizers, by thorough drainage, and by irrigation when necessary; and large towns afford an abundance of manure, and artificial fertilizers are of ready access.

Successful market-gardening demands the exercise, not only of the highest agricultural skill, but also of sound judgment in many other respects. The market-gardener must not only know what kind of crops are in themselves best adapted to his soil and climate, but how to cultivate them. He must study carefully the question as to what kinds will be demanded in his own immediate market, and at what particular season they will bring the best prices; and he must see to it that his products are ready at that time. Moreover, most of his crops are perishable in their nature, and so must be sold at once, or they are of no value. A few days' difference in time will often make all the difference between a great profit and a great loss. He should also so arrange a rotation in his crops that he may have one kind or another all through the season. His land will, indeed, have to do double duty, and must therefore receive double care; but it will give him more than quadruple results. There is one leading principle which he should always keep in mind: to grow those crops which will pay best in his special location, and with a part of the money which he receives in payment purchase what else he needs or wishes.

Long as is the list of garden vegetables, there can be no doubt that it may with profit be greatly extended. There are many excellent species and varieties perfectly adapted to one or another of our various climates which are wholly unknown in our markets. It is not many years since the tomato—one of the most valuable of all—was thought to be not only useless as food, but positively poisonous. Now and then a plant might be seen in cultivation for the sake of its brilliantly-colored fruit, which were known as "love-apples;" but children were carefully warned not to eat them. If, now, the value of all the tomatoes consumed—raw, cooked, or canned—could be stated, the amount would be sufficient to give it a high place among our garden products.

But it is not merely—not even chiefly—to the introduction of new species that the attention of the horticulturist should be directed. Very few of our garden vegetables are edible in their wild or native state. All of them, as we know them, are the result of human cultivation; and it is by no means probable that in respect to any one of them has the highest possible development been attained. Moreover, like all other partly artificial vegetable productions, they have a constant tendency to "run out" when long raised from the same stock. A variety may succeed unexceptionably for a number of years in some localities, and then rapidly degenerate there, while the same variety will take, so to speak, a new lease of life when transferred to another locality. The "breeding" of plants is as important as the breeding of animals, although the laws which govern it are not as yet so well understood. As yet the science is mainly an experimental one—an art, indeed, rather than a science; but so numerous and well-directed have the experiments become, that we may confidently hope that the governing laws will be discovered, and so the art will become a science. The horticulturist who in any degree practically aids in attaining this result can hardly fail to receive a due pecuniary reward for his labor.

Berries, etc.—The smaller fruits—such as currants, strawberries, blackberries, raspberries, and the like—are garden products, except when they are found growing wild; and although the wild fruit is valuable, the garden fruit far exceeds it in size and productiveness, and usually in flavor. Some of the choicest varieties of the blackberry and raspberry seem to have been originally produced by accident—that is, without man's aid. Some one discovered an unusually fine bush growing wild; he transplanted it, and by cultivation its good qualities were still further developed, transmitted to other generations of the plant, and so perpetuated.

The *Blackberry*, as a garden fruit, is the result of such an accident. A few years ago a remarkably fine bush was discovered growing wild near New Rochelle, a few miles from the city of New York. The discoverer transplanted it into his garden, where it flourished; and from this chance-found plant have sprung almost all of this fruit now grown.

The *Cranberry* is strictly a swamp-plant, but is also raised to some extent in gardens, where the soil is moist; but it requires that the beds into which the plant is set should have a thick coating of swamp-muck. Most of the cranberries of our markets are grown in a few swampy localities in five or six counties of New Jersey and Massachusetts. There are few acres of ground which can be made as profitable as a good cranberry-swamp. The fine flavor of this berry places it at the head of our acid berries.

The *Currant* is a very hardy shrub, and will grow fairly in almost any soil. Perhaps it is on this very account that so little attention has been given to its cultivation. Yet so excellent is the fruit, and so abundant its yield, that it ranks highest among our bush-fruits. Physicians whose practice lies in hospitals and asylums, and among children, welcome the arrival of the currant season, for the ripe fruit is one of the best preventives of what are known as "summer complaints." Moreover, the currant is less perishable than most other berries, so that the producer is less dependent upon an immediate sale, and any overplus of the yield can be profitably converted into jams and jellies. The currant season lasts longer than that of any other of our berries. This fruit is eminently worthy of the attention of the horticulturist, especially if a part of his land is not of the highest character. The plant will pay for itself anywhere, but will pay best where it is best treated.

The *Gooseberry* has not found much favor among us, the fruit being peculiarly liable to a destructive kind of "mould." English horticulturists have a fancy for raising gooseberries of enormous size for exhibition. To effect this they leave only a few berries on the bush, and carefully support each of them so that it does not hang by the stem. The unripe fruit is somewhat used for pies and tarts; but even for this use the rhubarb, or "pie-plant," is preferable, and is far more easily raised. Perhaps some valuable variety may be developed; but until this is the case the culture of the gooseberry for market is not likely to prove profitable.

The *Raspberry* is deservedly a favorite berry. There are numerous species, differing widely in the color and even the flavor of the fruit; but nearly all of them are hardy and prolific, and may be grown with profit both for home consumption and for market.

The *Strawberry.*—This, the most delicious of our berries, has some peculiarities which call for a higher degree of practised skill than is required for most other garden fruits. But this skill may be attained by any observant gardener; and the berry is among the most profitable of all when judiciously grown and marketed. The plant is frequently raised directly from the seed, and valuable varieties are numerous. Some of these varieties produce very large berries, but the flavor of these is usually inferior to those of a moderate size.

The *Whortleberry.*—As far as we know, no attempt has been made to cultivate this wide-spread berry, varieties of which flourish in every climate, from Florida to Maine, and at every elevation, from a sea-coast swamp to the very summit of Mount Washington. There are various species of the plant, bearing various local names, from a dwarf vine of only an inch high to a bush of eight or ten feet. Berries of excellent flavor, and in almost unlimited quantities, can be had in many sections merely for the picking, and large quantities of these wild berries are brought to all our markets. There seems to be no reason to doubt that this berry, excellent as it is, may be improved by cultivation; and the experiment is certainly worth trying. The fruit is among the least perishable of all our berries, and is, therefore, specially adapted for preserving or drying. It is also one of the few berries the flavor of which is not impaired by cooking.

The *Melon*, in its various species, is a profitable garden product where the climate and soil are adapted to it, and where a market is readily accessible. Except for home consumption, New Jersey and the southern part of New York are the northern limits where they will ordinarily be found profitable. Most of the melons sold in our markets are brought from the South. These are not unfrequently picked while wholly unripe, and left to ripen in the transit, and this kind of "ripening" is often only another name for rotting.

Floriculture.

The cultivation of flowers, not merely for personal gratification, but as a gainful employment, is almost a new avocation among us. Flower-markets have, indeed, long existed in New Orleans and other Southern cities, but anything worthy the name has not been known in the North until within a few years. But floriculture has of late grown into an important industry, although we find no notice of it in the Census Report (of 1880), except the bare mention that there were in all the States 4550 "florists," of whom 4,320 were males and 230 females, and that the number of children between ten and fifteen was only 82. One needs, however, only to walk along the streets of any of our cities to perceive that the arranging and selling of flowers, either in pots or "cut" for bouquets and for festal and funeral occasions, gives gainful employment to a much more considerable number of persons.

Flowers are, to a very large extent, grown in greenhouses, which are merely covered gardens, in which a summer temperature is maintained in the winter, thus supplying fresh flowers in the coldest weather. The cultivation of flowers for gain is confined mainly to the vicinity of large cities. The supply for New York—apart from the comparatively few produced in its own greenhouses—comes mainly from New Jersey. The sort of flowers profitable for cultivation depends somewhat upon the fluctuations in fashion; a kind of rose, for example, which is a special favorite one season being not unfrequently quite neglected the next season.

The cultivation of flowers for use in perfumery and cosmetics is altogether unknown in the United States, although in India, Persia, Turkey, and some parts of Europe, especially in France, it has long been carried on very largely; and fats and oils saturated with the perfume of flowers are a not inconsiderable article of import into the United States. It is not improbable that recent chemical discoveries, by which the most delicate odors of flowers are so closely imitated as to defy detection except by an expert, will greatly check this branch of floriculture. But there is no reason to believe that the taste for flowers themselves, and the consequent demand for them, will diminish; and most likely it will increase very greatly. Consequently, it may be safely assumed that floriculture is among the most promising of the minor industries which can be carried on in the vicinity of large cities.

In considering the benefits to be derived from the far wider extension of garden culture, whether of vegetables or flowers, a very important point is, that it would greatly enlarge the sphere of gainful labor for women. We do not desire—and certainly do not expect—that the time will ever come when women among us will be largely engaged in the common, laborious out-door work of the farm, as they are in some parts of Europe. But gardening furnishes much out-door gainful employment in which, even according to American ideas, women may appropriately engage. To plant and weed a garden-patch, and to gather its products, involves nothing more unfeminine than to tend a flower-bed or water a geranium-pot; and even the more laborious parts of garden-work are less severe than cooking and washing, to say nothing of scrubbing and scouring. They involve less physical exertion, and that of a more healthful kind, than standing behind a counter, sitting at the sewing-machine, or working in a factory.

From whatever stand-point we look at the matter, we reach the same result: that gardening opens one of the widest fields among us for profitable cultivation. Closely connected with the "Products of the Garden" are the "Products of the Orchard," which forms the subject of the next chapter.

CHAPTER VIII.

PRODUCTS OF THE ORCHARD.

THE various tropical and sub-tropical fruits, such as the banana, plantain, bread-fruit, cocoa-nut, and date, appear to be found very nearly in their natural condition, without having undergone any great change through cultivation. Some of these are of great importance in the regions where they flourish, constituting the main food of the people. The banana, or plantain, furnishes more food per acre than any other plant. According to Humboldt an area of ground which will yield 1000 pounds of potatoes will, in its own climate, yield 44,000 pounds of bananas; a surface bearing wheat enough to feed one person will, when planted with bananas, feed twenty-five persons. The fruit of the date-palm constitutes the chief article of food on the northern coast of Africa, in Arabia, and Persia. Each well-grown date-tree will yield from one hundred-weight to four hundred-weight per year, the dried fruit containing 58 per cent. of sugar, combined with gum, pectine, etc. In Egypt each date-tree is registered, and pays a special tax, which forms a considerable part of the revenues of the Government, and is, perhaps, the most burdensome tax imposed in any country. The cocoa-nut and bread-fruit are valuable where they will grow. But none of these tropical or sub-tropical fruits will, probably, flourish anywhere in the United States, with the exception, perhaps, of Southern Florida.

None of the fruits grown among us—with the exception of the grape and a few wild plums—are indigenous to this continent, but have been introduced from the Old World; but many of them have here found a habitat more congenial than their original homes. Although most of them are still found in the Old World in their wild state, they are, as we know them, the product of cultivation; but this cultivation often goes back to a period earlier than recorded history, and pagan myths attribute it to one or another of the gods.

Fruit-culture has as yet received far less attention among us than it deserves, and far less, it may be confidently predicted, than it will receive in the immediate future; for it is affirmed by all competent authorities that fruits, either in their natural state or cooked, should form a much larger proportion of the food of our people than they have ever done. And there is every reason to believe that the growing of fruits will, in the future, become one of our most remunerative industries.

Since 1850 the Census Reports have undertaken to give the value of the Orchard Products for each census year. Table VII. gives the results, in this respect, for the thirty years preceding, and including, 1880:

TABLE VII.—VALUE OF ORCHARD PRODUCTS, 1850, 1860, 1870, 1880.

State.	1880.	1870.	1860.	1850.	State.	1880.	1870.	1860.	1850.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*		*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
Ala....	362,263	37,590	223,312	15,408	Miss..	378,145	71,018	254,718	50,405
Ariz...	5,530	2,850	....	....	Mo....	1,812,873	2,617,452	810,975	514,711
Ark...	867,426	55,697	56,025	40,141	Mont...	1,530	....	....	....
Cal....	2,017,314	1,059,779	754,236	17,700	Neb...	72,244	9,932	125	....
Col....	3,246	9	....	....	Nev...	3,619	900	....	....
Conn..	456,246	599,718	508,848	175,118	N. H...	972,291	743,552	537,934	248,563
Dak...	156	....	....	....	N. J...	860,090	1,295,282	429,402	607,268
Del....	846,692	1,226,893	114,225	46,574	N.Mex.	26,706	13,609	19,751	8,231
D. C...	12,074	6,781	9,980	14,843	N. Y...	8,409,794	8,347,417	3,726,780	1,761,950
Florida	758,295	53,639	21,259	1,280	N. C...	903,513	394,749	643,688	34,348
Ga....	782,972	352,926	176,048	92,776	Ohio .	3,576,242	5,843,679	1,929,309	695,921
Idaho.	23,147	725	....	......	Oregon	583,663	719,875	478,479	1,271
Illinois	3,502,583	3,571,789	1,126,323	446,049	Pa....	4,862,826	4,208,094	1,479,937	723,389
Ind....	2,757,359	2,858,086	1,258,242	324,940	R. I...	58,751	43,036	83,691	63,994
Iowa..	1,494,365	1,075,169	118,377	8,434	S. C...	78,934	47,960	213,989	35,108
Kan...	358,860	158,046	656	....	Tenn...	919,844	571,520	305,003	52,894
Ky....	1,377,670	1,231,385	604,849	106,230	Texas.	876,844	69,172	48,047	12,505
La....	188,604	142,129	114,339	22,359	Utah..	148,493	43,938	9,281	....
Maine.	1,112,026	874,569	501,767	342,865	Vt....	640,942	682,241	211,693	315,255
Md....	1,563,188	1,319,405	252,196	164,051	Va....	1,609,663	891,231	800,650	177,137
Mass..	1,005,303	939,854	925,519	463,995	Wash..	127,668	71,863	20,619	....
Mich..	2,760,677	3,447,985	1,122,074	132,650	W. Va.	934,400	848,773	....	....
Minn..	121,648	15,818	649	....	Wis...	639,435	819,268	78,690	4,823
	carry over.	*carry over.*	*carry over.*	*c'y over.*		50,876,154	47,335,189	19,991,885	7,723,186

In the Census Report of 1870 (as heretofore said) the values are expressed in "currency," which, for the purpose of comparison with other years, should be reduced to its gold value by a deduction of one-fifth. The real value of the orchard products of 1870, instead of being $47,855,189, was $37,868,151, in gold. The same deduction should be made in the values for 1870 in each of the States. It thus appears that the increase in the value of orchard products from 1850 to 1860 was 159 per cent.; from 1860 to 1870 it was 89 per cent.; from 1870 to 1880 it was 34 per cent.—the ratio of increase being a little more than that of the increase of population. It will be seen, also, from the table that in the vast fruit-growing regions of the Central, Northeastern, and older Western States there was a very considerable relative decrease in the value of the orchard products of 1880 as compared with those of 1870. In some of these States there was an absolute decrease. Thus, the product in Delaware, Kentucky, and New Jersey fell off, while Indiana, Illinois, Michigan, and New York barely held their own. But this decrease was more than compensated by the extraordinary increase in California and in nearly all of the Southern States. From 1870 to 1880 the orchard products of California doubled; in Georgia they increased nearly threefold; in Mississippi, sixfold; in Alabama, elevenfold; in Florida, fifteenfold; in Texas, sixteenfold; in Arkansas, seventeenfold. Taking the whole Union through, and notwithstanding the bad Northern and Western fruit-year 1880, the increase in orchard products from 1870 to 1880 has more than kept up with the increase of population. And nothing can be more certain than that this increase will go on for a long course of years; for the taste for fruit is so natural, and its gratification so healthful, that the demand for it must inevitably increase. The value of the orchard products in 1880 being $50,876,154, and the population numbering 50,155,783, there was almost exactly a dollar's worth for each individual; and, making the highest possible estimate for imported fruits, each person in the United States does not consume fruit to the amount of a dollar and a half a year—less than three cents a week.

There is not, probably, a single valuable fruit grown in any part of Europe or in the temperate regions of Asia which may not be successfully reared in some portion of the United States. We give some account of the leading fruits, noting the main sections of the country which, by reason of climate and soil, are best fitted for their successful cultivation: grouping them into two divisions, Northern and Southern.

Northern Fruits.

THE APPLE.—The apple-tree, as we know it, has been developed by cultivation from the sour and almost inedible "crab-apple" of England. It was brought over by the earliest emigrants, who here found every condition favorable to its growth, and for some generations the apple-tree hardly needed any cultivation. The soil of New England and New York was composed of decayed trees and their foliage, thickly covered with the ashes of the primitive woods; while the greater portion of the country was still sheltered by the primeval forests, which mitigated the keen winds of winter and early spring, affording protection to the apple. The snows apparently fell more heavily than now, or at least lay longer upon the ground, protecting roots of the fruit-trees from the frost, and retarding premature blossoming. Other fruit-trees shared in these advantages; so that it was far easier a century ago to raise fine peaches in Southern New Hampshire than it now is in Southern New York.

The apple constitutes, and must constitute, the most valuable orchard product of the more northern part of the United States; while the orange will be the special fruit of the most southern portion, upon the Atlantic side, and of Southern California as far north as the latitude of North Carolina and Tennessee; the peach lying intermediate between them, south of the apple zone, and north of the orange zone.

That the apple-orchards of New England and New York have failed rapidly for several decades is unquestioned. But the causes of this failure have been wholly misunderstood. Upon this point, and indeed upon most others connected with the apple, we cite, with abridgments required by our space, Mr. Todd's admirable *Apple Culturist.* He says:

"The failure of apple-orchards is a matter of common conversation in all localities where apples are cultivated. In the majority of instances it is assumed that apple-trees fail to produce such crops as were once raised in certain localities because the varieties are running out. The assumption is erroneous. If the same quality of soil can be secured, with the same surroundings as to protection by forests, and if the cions from the topmost boughs of old trees that have once borne bountiful crops of fine fruit, but have now failed, could be set in young stocks, as hardy as those which were employed seventy or eighty years ago, we should see trees loaded with just as fine fruit as those old trees ever produced. There is a limit to productiveness of all kinds, vegetable or animal. Old animals cease to bear young; forest-trees reach the limit of their growth, and decay. Durham cattle die; but the *breed*, the *variety*, does not deteriorate. So with fruit-trees. If the old trees cease to bear, and die, the *variety* of the fruit does not fail, if cions of the branches be set in young stocks."

Mr. Todd affirms — and proves — that the trouble in respect to the orchard lies in the treatment of the growing trees. He sets forth the chief of the errors in their treatment. We summarize his principal points:

"1. Fourscore years ago the stocks into which the cions were set were produced from more hardy varieties than they now are. 2. Then, the fruit-trees were set in a virgin soil, which had been bountifully top-dressed with unleached ashes, an almost indispensable requisite for the production of fine fruit. Now, inferior trees are planted in an inferior soil, without wood-ashes and other necessary fertilizing materials. 3. Then, almost every orchard was shielded by a belt of forest-trees. Now, cold and fierce winds sweep over the country for a long distance, raking young orchards in a fearful manner. 4. A large proportion of the orchards have been ruined by mismanagement. The soil having become impoverished by yielding a long succession of bountiful crops, and the trees beginning to show signs of starvation, resort was had to a stupid mode of pruning. Half, or even more, of the entire top was rudely cut off, including limbs six or eight inches in diameter, making wounds so large that they could never heal over. Hence the trunk began to decay at the heart, often becoming quite hollow."

The section on the "starving out" of apple-trees is especially worthy of careful consideration. A young orchard is planted, and forthwith sown to a grain crop; and year after year the tops of the young trees rise just above the growing grain; yet the land is expected to bear as much of other crops as though no fruit-trees were upon it. After due time, perhaps half or two-thirds of the apple-trees will be found to have survived this early starvation, and to bear a little fruit. Then a little mercy is shown to the trees: the orchard is seeded down, and after one or two mowings is converted into a pasture; but the idea of manuring an orchard never occurs. No attempt is made to restore the elements exhausted by the production of the crop. "The soil is robbed of its nutritive properties year after year; no new supply is furnished: and out of nothing, nothing comes. The practical lesson is obvious: we must feed our fruit-trees, if we expect them to feed us."

Fruit-trees and their fruit are, like all cultivated crops, exposed to the attacks of insects and other depredators. Mr. Todd devotes due space to the methods more or less successfully employed to get rid of these destroyers, but the main result is briefly enough summed up:

> "New depredators have been visiting our fruit-trees every season for a number of years past; and for years to come others, now unknown, will probably appear. There may be some remedy discovered to head them off; but the most reliable one of all will be, 'Catch 'em and kill 'em.' All through the growing season every employé on the premises should be instructed, whenever he sees noxious insects at work, to drop all other employment, and 'catch 'em and kill 'em.' We have tried the 'Shoo-fly!' remedy quite too long, without any satisfactory results. If we drive them away, they are back to their work of devastation before we can return. But if we 'catch 'em and kill 'em' they never have a resurrection."

Various modes of catching and killing these pests are set forth; and the fruit-grower can in no way earn more money in a few hours than by making himself master of this chapter of the *Apple Culturist.*

The apple-tree, like every other, finds some soils specially adapted to it. The best soil is where there is a liberal supply of both clay and sand; for without these they will not yield abundantly for any long time. A good, fertile loam, which supplies both, is excellent, or a deep, alluvial soil, if of the right character. If the soil is wanting in one of these elements, the deficiency must be supplied. If one of them is in excess, the other must be added as a counteractive. If there be too much clay, add sand; if too much sand, add clay, and so on. Moreover, continues Mr. Todd, emphatically:

"Pile on also gas-house lime, old lime, and quick-lime; leached and unleached coal ashes; chip-dirt, sawdust, fertile street-dirt; scrapings of the manure-yard, tan-bark, leather-shavings, refuse of woollen-mills, and all such kind of material as can be secured. It will pay to cart sawdust two miles to put around apple-trees, as such material will furnish much of the best quality of food for the hungry roots of growing trees. Good barn-yard manure is also excellent for growing trees, and there is no danger of applying too much of it. But all such articles should be worked into the soil, where the roots can feed on such portions as will promote the growth of the trees and the development of the fruit."

The *Apple Culturist* does not content itself with dogmatically putting forth these and such-like directions; it shows the reasons for them, based, not only upon actual experience, but upon scientific principles. For all the purposes of fruit-culture it is a thorough hand-book of agricultural chemistry. While, as above, the author affirms that, in the case of the apple-tree, "there is no danger of applying too much manure," he is careful to qualify the statement in so far as the peach and its kindred are concerned. These, he says, "will not bear a high fertility, because, being brought originally from warmer countries, they are liable to suffer from the frosts of winter, and are stimulated to grow too late in the season, and the frost strikes them when the wood is immature." The subjects of planting and transplanting fruit-trees, and the proper modes of pruning, are fully treated.

All choice varieties of the apple are produced from grafted trees. Given a suitable soil and proper culture, a sound stock upon which to graft, and a cion from a tree capable of bearing the desired variety of fruit, and yet a skilful grafting is required to insure the desired result. The chapter devoted to this subject is so clearly expressed and so fully illustrated by delineations of every necessary implement and appliance, and the manner of using them, that it requires only a reasonable amount of intelligence, and a fair degree of manual dexterity, for any fruit-grower to do his own grafting and budding. By so qualifying himself he will be able to dispense with the at best questionable services of those itinerant grafters who are more likely than not to be wholly unfit for the work they undertake.

The special value of the apple arises partly from the intrinsic excellence of the fruit, and partly from its permanence. Our earliest apples ripen in June or July; some "winter" sorts will keep until the following summer. So that there is no day in the year in which apples are not to be had. The real value of the apple, even in a mere pecuniary point of view, is too little appreciated. We again quote from the *Apple Culturist*, the writer speaking especially of Western New York, "where," as he says, "the tree is hardy and healthy, and the fruit comes nearest to perfection," although what is affirmed holds good for a much greater extent of country:

"No other trees can be relied upon for a regular supply of choice fruit, with such certainty of a crop, as the apple-tree; and there is no other kind of fruit that can be made to mature during such a long succession of months. They are excellent while in a crude state, and superb when cooked in a score of different ways. By no earthly process can so much nutriment be so cheaply extracted from four square rods of ground as by planting an apple-tree in its centre, and giving it good cultivation. Every family that is in possession of only a few roods of good ground should have a succession of apples suited to every season of the year. If a person has the land, there can be no possible excuse for not having a bountiful supply of superior fruit in from six to ten years, unless we except the pretext so often urged, of a 'want of time' to cultivate the trees. But every man fritters away every season far more time than would be required to plant an orchard and to take care of the number of trees requisite to supply his family with apples during the entire year. They are unlike the more perishable fruits, as pears, peaches, and plums, which must be consumed to-day, or they will be worthless to-morrow. The choice varieties are now so numerous that, by proper management, in our latitude, any family that will appropriate only a part of one acre to a few trees which mature in succession may begin to gather ripe apples in July, while they have still in their cellar a small supply of last year's apples."

The writer enumerates nearly a score and a half of well-known varieties, "which will furnish a succession from the middle of July of one year to the same period—or even later—of the following year." Among the varieties enumerated are the Early Harvest, the Tallman Sweeting, the Early Chandler, the Fall Orange, the Rhode Island Greening, the Ladies' Sweet, the Baldwin, the Summer Pearmain, the Early Strawberry, the None-such, the Summer Pippin, the Roxbury Russet. "One tree of each of the foregoing varieties," it is added, "if properly cultivated, would supply a small family with all the fruit they would need during the year, before the trees are half-grown. Those who desire extensive orchards can add other varieties to suit the locality or the market."

Much of all the foregoing will apply, in many respects, to the peach, the pear, the plum, etc. It was written, however, before the culture of the orange in California and Florida had assumed its present great importance, and its still greater promise for the future. Not improbably the apple and the orange will share between them the joint sovereignty over the realm of American fruit-culture—the apple being king in the North, and the orange being queen in the South.

The Pear.—The wild pear-tree, found in the temperate parts of Asia, is hardly more than a shrub. The fruit was known to the Romans before the beginning of the Christian era, but was not much relished unless cooked. The delicious varieties which we know as the Seckel, the Vergaloo, the Bartlett, etc., are the result of modern cultivation. The general conditions for the cultivation of the pear are very similar to those of the apple. The pear is grown as a standard tree, or is budded upon its own seedlings, or upon the quince, etc. Some pears are best if picked before fully mature and suffered to ripen in the house. The coarser varieties are used mainly for cooking or canning. Many of the finest varieties are grown as dwarfs. The best are grown in Southern New York, New Jersey, and especially in California, where the fruit attains a great size without losing its flavor.

The Peach.—The peach-tree flourishes in the middle region of the temperate zone on both continents, although not indigenous on this. It can be grown in England only as a wall-fruit. Its cultivation was formerly carried as far north as Central New York and Southern New England; but its boundaries have gradually receded southward. The best peaches are now produced upon Long Island, in New Jersey, and especially in Delaware and portions of Maryland. Farther South, as in Virginia, the peach is much used for the distillation of what is known as "peach-brandy." The best peaches are perhaps the most delicious of our fruits. But they are quite perishable individually, although different varieties ripen at different periods, so that the fruit is in market for several months in the year. Large quantities are preserved by drying and canning; and the disadvantages arising from the perishable nature of the fruit are thus partly obviated. The cultivation of the peach for the market upon a small scale is not likely to be profitable, except in few and limited localities; but large peach-orchards have been found to afford a very lucrative investment for capital and labor. To secure this result, however, depends quite as much upon marketing the fruit as upon growing it.

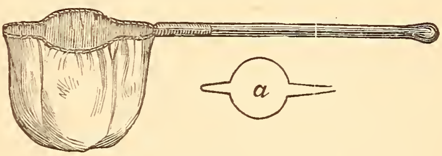
The Cherry.—Our cultivated cherries, of which there are many varieties, belong to species introduced from the Old World. There are numerous varieties of wild cherry-trees on both continents. In the United States the chief varieties of wild-cherry are the "choke-cherry," a mere shrub, and the "black-cherry," a large tree, which produces valuable timber, much used in cabinet-work. Some of the cultivated species are excellent fruits; but the crop is rather uncertain.

Plums.—The various species of plums do not, as yet, form any considerable part of the orchard products of the United States. Two or three species of wild-plum, which are now cultivated to some extent, were about the only fruit, excepting grapes, known to the aborigines of North America. In many parts of Europe plums, or "stone-fruit," are largely grown. The dried fruit of several species goes under the general name of "prunes," or "prunelles," and forms an important article of consumption and export from France, Germany, Spain, and Turkey. The French prunes, which are considered the best, are mainly the product of what is locally known as the St. Julian plum. The production of dried plums, or prunes, has been begun in California, with quite satisfactory results.

The gathering of fruit—especially of apples—deserves more consideration than it usually receives. Care is required, in the first place, not to injure the tree itself. In case the fruit has been blown off, or has fallen of itself from the tree, it is too late for care in this respect. There is skill required for picking an apple even by hand. "Beginners," says *The Apple Culturist*—

"Should be taught how to pick an apple or pear, when the stem separates with difficulty, so as not to break off the fruit-spurs, or injure the buds which are to produce the next year's crop. There is a proper place for every stem to separate from the spur. A straight pull will often remove pieces of the twig several inches in length. When fruits are shaken off they often take long pieces of wood with them. These have to be separated from the fruit, and it is far better to take a little pains and leave the wood on the tree. When the apple is to be plucked apply the thumb-nail to the stem at the proper place for separation, and break the stem across the nail. Much damage is often done to fruit-trees in gathering the fruit. Large branches are trodden on and barked, small ones are broken, and, in violently shaking the trees, fruit-spurs are broken off."

Much fruit will hang where it cannot be reached by the hand. To gather this one needs a "fruit-plucker." This can be readily constructed by bending a stout wire about thirty-two inches long, into the shape shown at *a* in the cut; the two ends being brought together, drive them into a light pole, like a broom-handle; then to the wire attach a sack large enough to hold six or eight apples, and you have the fruit-plucker shown in the illustration. The fruit is pulled off by the narrow loop-end of the plucker. It is well to have three or four of these, with handles of different lengths, say from five to twelve feet.



A CHEAP FRUIT-PLUCKER.

The chief point, so far as the fruit is concerned, is to prevent its being bruised, either in picking or subsequently. The fruit itself possesses a kind of vitality, not only in the seed, but in the pulp and skin. Deprived of this vitality, all that is valuable is gone. A rotten apple, or one that has been frozen and thawed, has no vitality left except in the seed. But it should be borne in mind that an apple does not freeze until the temperature is from five to ten degrees below the freezing-point of water. It is well, indeed, to keep winter apples where the temperature is close down to the freezing-point of water.

Just as a bruise tends to destroy the vitality of the human system and induce decay of the bruised parts, so even the apparently superficial bruising of an apple or other fruit causes it speedily to rot. The slightest abrasion of the skin, or the crushing the cells of the pulp containing the juice, induces fermentation and decomposition, and the consequent decay of the whole mass. There is every reason to apprehend that an apple which falls from the tree will be badly bruised. And therefore, says the *Apple Culturist*—

"For this reason hand-picking should be practised in preference to any other mode, if the fruit is to be kept for spring and summer use. When picked lay those designed for long keeping carefully in the basket with the hand, instead of throwing them in. Winter apples should not be poured from one basket to another, any more than eggs should be. Nor should they be handled in full bags, for they will be bruised in these more than in any other receptacle."

For the preservation of winter apples the essential thing is, that they should be kept in a cool, dry, and well-ventilated place. The best means of treating them before cold weather sets in is to place them upon a floor a few feet above the ground, with a roof overhead, and ventilating openings in the sides, sufficient to permit a free circulation of air at all times. Most cellars are too close and damp for apples until after the weather has become cold and freezing. In a cellar where apples are to be kept the temperature should never be allowed to quite reach the freezing-point of water (32° Fahr.).

The preservation of fruits by canning is an important industry. Apples, indeed, keep so well, that though often dried they are rarely canned. But the value of the peach, pear, and plum crop is greatly enhanced by this process, since by it large quantities of these fruits, as well as of the more perishable vegetables —such as tomatoes—are saved, which would otherwise have been lost. Very ingenious machinery has been devised for the manufacture of the tinned cans at a small cost. But for many kinds all metallic cans are objectionable, and for some, especially for pickles, they are wholly inadmissible. The great objection to the ordinary tinned cans is, that the solder used is composed mainly of lead; and lead, when acted upon by an acid, produces a very dangerous poison. Glass cans would be in every respect preferable to tinned ones, and they are much used. The main thing to be desired in this respect is the devising of some method by which glass cans may be quickly and effectively sealed. It would seem that this is a mechanical problem presenting no serious difficulty.

While the canning of fruits for market will be mainly carried on in large establishments, every family which raises any of the suitable fruits or vegetables should be able to thus preserve sufficient for its own consumption, and perhaps even more. This would be a not unimportant addition to our paying industries; for any process which saves anything which would otherwise be lost, or secures a new use for an article already produced, is in so far a profitable one.

One other aspect of fruit-culture is worthy of consideration from a hygienic point of view. All fruits contain a large percentage of water. In the apple there is about 80 per cent., in the peach and grape still more. This water is perfectly pure. No matter how foul may be the water which is presented to the roots of the tree, they reject all the impurities from the sap, which consists of pure water, only sweetened, acidulated, or flavored according to the special nature of the fruit. The person, therefore, who eats ripe fruit is actually drinking; and to drink is as essential to life as to eat. It is even more immediately essential; for a person can survive nearly as many days without eating as he can survive hours without drinking. A person who on a hot summer day eats two or three apples or peaches, or a handful of grapes, actually drinks a gobletful of water; and the sensation of thirst will thereby be quite as effectually allayed. Among the most prevalent causes of disease in many localities is the impurity of the drinking-water. Many persons, moreover, find, in travelling, that certain water, though not deleterious to those accustomed to it, does not "agree" with them. In such cases it is better to quench the thirst by a free use of fruit, if it is to be had, than by drinking doubtful water or fermented or distilled liquors.

From the fruits especially belonging to the Northern portions of the United States we proceed to those which belong more especially to the Southern portions.

Southern Fruits.

THE ORANGE.—The orange-tree is, apparently, of tropical origin. At all events it now flourishes in South America directly under the equator. It was not known in Europe until the eleventh century, when it was introduced into Spain by the Moors. It was brought to this continent by the Spaniards and Portuguese. Of all the fruits brought from the Old World, the orange is perhaps the only one which grows wild in America, as it does in Florida and Brazil.

The orange-tree is of slow growth. Fifteen years is the time assigned in France for an orange-tree to come into full bearing. Until quite recently it was believed that in California an orange-orchard could not be made to yield a profit under ten years. "But now" (1882), says Mr. Nordhoff, our best authority on this point, "by the method of budding, dwarf-trees are produced which begin to bear in five years from the bud, and yield paying crops in six years." But he adds that "farther experience is required to establish whether these budded trees will be as long-lived or as full-bearing as seedlings and standards; but they seem, at any rate, to shorten the period of waiting for a profitable orchard." Probably both methods of propagation will be adopted, under different circumstances. In either case there is every certainty that the orange-culture in California and Florida will in the future be an exceedingly profitable one. There is no reason to doubt that in Alabama, Arkansas, and the adjacent States, orange-culture will be profitable.

Until within a very few years all the oranges consumed in the United States were imported mainly from the shores of the Mediterranean and the West Indies. In 1874 there were brought to New York about 130,000,000 oranges from Europe, and about 32,000,000 from the West Indies. Assuming that they brought only one cent apiece, the value of the import into this port was a million and a half of dollars. But as the fruit

VINTAGE AT SAN GABRIEL.

IRRIGATING AN ORANGE GROVE.

See Note 3.

has to make a long voyage, it is usually picked while quite green, and it does not attain its best flavor when ripened off the tree. The Florida or California grower need labor under no such disadvantage. He can wait until his fruit is nearly ripe before picking it; so that it will reach the market in a much better condition than the foreign fruit. The sudden growth of orange-culture in Florida is remarkable. In 1870 the value of the entire orchard products of the State was only about $50,000; in 1880 they amounted to more than $750,000—an increase of fifteenfold; and by far the greater part of this product consisted of oranges.

Mr. Nordhoff visited California in 1871, when, as he says, "the question of the permanent and very great profitableness of the orange-culture was still open; but now (1882) it is settled." From his work we quote, with necessary abridgments:

"The orange, lemon, and lime are now planted on a large scale in several parts of the State, and especially in Los Angeles and San Bernardino counties (which together have an area about half as large as the State of New York), where they will before long form one of the chief crops. Their culture has been prosecuted with much intelligence, with the result that the area of suitable soil has been widened, and new and earlier-bearing varieties have been introduced or created. They do not at present succeed on the San Joaquin and Sacramento plains, and may never be a profitable crop there. But in the foot-hills, both in the San Joaquin and the Sacramento valleys, the orange and the lemon already do well. As this great foot-hill region, now containing the best and cheapest lands in the State, becomes settled by small farmers it will be discovered that here is the real and best fruit country of California."

The orange-tree is certainly a most prolific bearer, even though one particular one—mentioned by Mr. Nordhoff—be exceptional. This tree, he says, "bore, at thirteen years, 2250 oranges, which brought the owner $74. The following year (1880) it bore 2050; but it had evidently overdone itself, for in 1881 it had less than half this number of oranges upon it." But, taking an average of good trees, the profits of orange-growing must be very large.

"They plant," says Nordhoff, "from eighty to one hundred trees per acre. Eighty trees, bearing 1000 oranges each, sold at $10 per thousand, would yield a gross return of $800. One man can cultivate, irrigate, prune, and care for twenty acres of any of the citrus fruits; and the picking and boxing costs no more than $1.50 per thousand. The trees are long-lived, where they have good care, and in proper localities are not subject to serious diseases. But they require thorough and constant culture, and the man who lets weeds dispute the ground with his trees will soon find his orchard diseased."

Lemons and limes are cultivated in California, and, when the best varieties are grown, they are as certain and profitable as oranges. Lemon-trees, it is said, in order to do well, should be planted in sheltered localities. It was formerly held that orange and lemon trees should, in California, be irrigated as often as once in six weeks. But the best opinion now is that four or five applications of water is not only sufficient, but that the tree will be maintained in a more healthy condition. One of the shrewdest Californian orchardists averred that, at half a cent apiece, the orange crop would be the most profitable which a man could grow. "And he was right," says Nordhoff, "for half a cent each would be five dollars per thousand, which, for mature trees, would give a gross return of ten dollars to the tree, or from $800 to $1000 per acre, according to the number of trees planted to the acre in different localities." He acknowledges that such returns seemed to him almost incredible, and adds:

"I needed, to enable me to realize the practical results, some such statement as was made to me by one of the most careful and intelligent orange-cultivators I met—the owner of twenty acres in a choice location. He said, 'Last year my trees paid the whole of my family expenses for the year; and that was my first crop. This year I shall make over $5000 clear. After next year I am planning to take my family for six months to Europe; and I expect thereafter to have four or five months for travel every year, with sufficient means from my twenty acres to go where my wife and children may wish to go.' For this result he had labored, with no severe toil, for nine years in a delightful climate; and I could not but compare his fortunes with those of a professional man or merchant—not to speak of an Eastern farmer—toiling severely for an equal number of years, with small hope of any such results."

Of course, land presumed to be capable of producing such results will command a high price. If it did not we might be certain that the statements were greatly exaggerated, or that there was some serious drawback, either certain or to be apprehended. And Mr. Nordhoff fairly states the great apparent drawback in California when he says:

"California is subject to droughts. Experience shows so far that there are about seven good years out of ten—that is to say, in ten years the farmer may, in almost any part of the State fit for general agriculture, expect to get seven good field crops without irrigation. Moreover, the farmer in Southern California who should plant the orange, lemon, and other semi-tropical fruits needs water to irrigate these. For these reasons it is a very great advantage to have a water-supply on your place, or at least within reach. 'Be more careful to buy water than land,' said an experienced farmer to me—a man who, beginning with a small capital, fifteen years ago, has now an income of $15,000 a year from his farm and orchards."

It is not, according to Nordhoff, that water, except in years of drought, is absolutely scarce in California, or rather that the quantity necessary is much less than is generally supposed. But still, artificial irrigation is so essential that the success of the "colony settlements" of Southern California — such as Anaheim and Riverside — is attributed greatly to this. "All these colonies began with an irrigation-ditch; and where water is thus secured the price of land at once rises from two dollars and a half to thirty or forty dollars an acre." The direct bearing of these considerations upon the question of the present condition and future prospects of orange-growing in California is thus summed up:

"The practice of budding oranges and lemons has, in a measure, revolutionized this culture, because budded roots bear much earlier, yielding a moderately profitable crop at five years; and the best and highest priced varieties are grown on budded stocks. And on such an assured basis is this culture now, that in localities where the orange and lemon are known to do well—as at Orange and San Gabriel, in Los Angeles County, and at Riverside, in San Bernardino County—orange land is now readily sold at two hundred dollars and more an acre—with water, of course—and is not thought dear at that price. But before its use was established the same land, subdivided for colony settlements, and with water brought to it, was thought dear at thirty-five dollars per acre."

There are, however, and probably for years will be, in California large tracts of land equally fitted for the culture of the orange which may be purchased at a moderate rate; and to these the attention of a person with only a moderate capital will necessarily be directed. Mr. Nordhoff says:

"For farmers of moderate means, say from $1000 to $3000, there are in all parts of the State profitable and pleasant locations in abundance. Such persons, in my judgment, should not undertake wheat culture, because they can do better on small farms of twenty to forty acres with grapes or orchard fruits. I advise new-comers with a small capital to content themselves with small farms. By good cultivation men can make far more from twenty acres, rightly planted, than from a square mile of wheat. Moreover, California is, for small farmers, still an open and almost unexplored land. The best locations are by no means all taken up; the most profitable cultures have but just fairly begun; and the farmer who settles himself there in the next ten years has a better chance of success than those who settled ten years ago, because he has the experience gained in the past ten years to go upon."

But it must be borne in mind that California, with all its capabilities for profitable fruit-growing, is not a country in which men acquire wealth or competence suddenly, or without hard work. While Nordhoff believes it to afford the "best opportunities for men willing to work on land that are to be found on this continent," he says, most emphatically: "It affords no opportunities at all for young men who want to follow sedentary or in-door employments. Clerks, no matter of what kind, California is full of. Of idlers, city people, young men who want to dress nicely and do as little as possible, it has much more than its share. To every one who belongs to this rather large class my advice is, to go anywhere except to California. He will starve there rather more quickly than in New York."

THE APRICOT.—The apricot belongs rather to our Southern than to our Northern fruits. It is grown to some extent as far north as Southern New York, but there the tree attains only a very moderate size. "But," says Nordhoff—

"The climate of California appears to be especially suited to the apricot. It begins to bear the third year after planting out from nursery rows. It is, so far, free from disease, bears abundantly, and grows to so great a size that I have seen single specimens which had the appearance of half-grown forest-trees. It has but recently come into general cultivation, and I do not doubt will continue, for a long time to come, to be one of the most profitable of the orchard trees of

California. Its congener the nectarine has more lately come into orchard use, and less is known of it."

Plums.—The prune and other plums are also among the fruits more recently introduced into California; and the prospects for them are encouraging. These, as well as the apricot, are chiefly used for canning. Nordhoff says: "All these trees do well in almost all parts of the State, and where canning factories are established a profit of from $100 to $200 per acre can be counted upon by the farmer. The canned fruits of California, of which the apricot is the most important, are mainly exported to Europe. These fruits are also dried to a considerable extent, but chiefly where they are grown too far from market to render profitable their shipment as fresh fruit.

The Olive.—The olive is the most important fruit-tree in all parts of the Old World where it flourishes. The northern limit of its profitable cultivation in Europe is the southern extremity of France. It is, next to bread-stuffs, pre-eminently the crop of Spain, Italy, and most of the coasts and islands of the Mediterranean. The fruit is used as food to a very limited extent, and only (when pickled) as a relish. Its great value is for its oil, which in Southern Europe takes the place which butter and the animal fats hold with us; and American lard appears to be gradually taking the place of olive-oil for cooking purposes in Italy. Among us the use of olive-oil is almost wholly confined to salads. The cultivation of the olive-tree has been introduced into California, where it thrives fairly with proper care, and yields excellent fruit. But, according to Nordhoff, "the olive has proved a success in only few hands. It is a slow bearer, and it has been attacked by several enemies wherever it has been planted in Southern California. I have no doubt that the earlier maturity and greater profitableness of the citrus fruits, and of the apricot, prune, and peach, have made men shy of planting olive-orchards." Still, there seem to be different opinions in California upon this subject, for he tells us also that "the general opinion is, that olives will prove as profitable as oranges, and that a bearing orchard will yield from $500 to $700 per acre net profit, the cost of care, picking, and oil-making being somewhat more than that of marketing oranges and lemons."

The cultivation of the olive in California has been so recently introduced that the question of its profitableness must be considered as undecided. Mr. Nordhoff says: "Mr. Cooper, near Santa Barbara, has the largest and most successful bearing orchard in the State, and he has found it very profitable. He began making oil in 1880, and found an urgent demand for all his crop, at prices which he told me realized all his expectations of the great value of these trees. His olive-oil has (1882) already a fame of its own in the Eastern States, and he and others who now make olive-oil could sell much more than they produce. The pickled olives of California are the finest I have ever eaten, and will be preferred to French or Spanish olives by all who have a taste for this delicacy." To us it seems improbable that olive-growing in California will ever attain the place of a great industry, and for the reason that the American demand for its product must be quite limited. No great amount of salad-oil or pickled olives will probably be required among us. Any considerable increase above the present production would apparently glut the market, while in the case of the fruits already spoken of the demand cannot fail to be one constantly and rapidly growing.

The Almond.—The culture of the almond-tree has been introduced into California, but apparently with only quite moderate success. There are now, according to Nordhoff, "almond-orchards in several parts of the State ten or twelve years old—old enough to yield full crops. The general testimony of almond-growers is, that the tree is an abundant bearer, when it bears at all, but that its habits are shy and uncertain." One almond-grower, who had about 9000 trees, had an excellent crop in 1881, but a very meagre one for the three preceding years: why he could not tell, for he had given his trees the best of care. The most successful almond-grower met by Nordhoff had several thousand trees, and the crop of 1881 was what he thought a good one, averaging fifteen pounds to a tree. The price at that time was fourteen cents a pound; the cost of picking, hulling, bleaching, etc., about four cents per pound, leaving ten cents a pound clear profit, which, allowing 150 trees to the acre, would give $225 clear profit per acre. "I judge," says Mr. Nordhoff, "from all that I heard, that the almond has not become a favorite tree in the southern part of the State, but that its main success will be in sheltered localities north of Sacramento, and more probably in the foot-hills than on the plains."

The English Walnut.—This noble tree belongs rather to the forest than to the orchard. Its fruit is commonly known among us as the "Madeira nut." Attempts have been made to introduce it into our Northern States, but there it rarely ripens its nuts. Not improbably it would flourish farther South, say from the Carolinas to Texas. It certainly flourishes admirably in California, where its growth is very profitable. Mr. Nordhoff says of it:

> "It will do well in almost all parts of the State, and is one of the trees which should be planted by farmers in their borders or in pastures, for when it matures it is like a forest-tree, and requires little care. It begins to bear at about eight years, but does not give a full crop until fifteen years old. Some orchards, twelve and thirteen years old, about Los Angeles and Santa Barbara, now bear at the rate of $200 to $350 per acre net profit, and this with very little care, as the tree is not subject to the attacks of insects or disease. I believe that this tree will make the most rapid growth in rather moist soil, and that where alfalfa is grown, which has to be frequently irrigated, the English walnut would succeed, if planted in the borders or along the water-ditches."

Leaving quite out of view the advantage of the English walnut as a nut-bearer, it should be among the trees planted as forest-trees. And now that the subject of forest-planting is beginning to receive the attention which it deserves, it is eminently desirable that it should be definitely ascertained where this walnut can be grown. The Italian chestnut is another tree well worthy of experimental culture. In some parts of Southern Europe its roasted or boiled nuts almost take the place of bread in the food of the peasantry. It is said that Jefferson tried to naturalize this tree in Virginia nearly a century ago. The chestnut is among the noblest of European forest-trees. The largest and probably the oldest tree in Europe is the great chestnut of Mount Etna, now almost decayed, whose hollow trunk, before branching off, measures 160 feet in circumference. It was famous for its size more than five centuries ago, and is believed to be much more than a thousand years old.

Apropos to fruit culture in California, or, indeed, to production in any part of the country, the wise man, in seeking his opportunities, will always take into consideration the question of transportation. If but one railroad is likely to carry his products to market, he can rest assured that a large part of the profits of his ventures will be absorbed in carriage. The temptation is always great on the part of the corporation to increase dividends. It might be better to locate where the yield was much less, and the facilities for reaching a market were much greater, especially where perishable fruits are concerned.

CHAPTER IX.

PRODUCTS OF THE VINEYARD.

GRAPES.—The vine is perhaps the most widely extended of fruit-bearing plants. It is indigenous to both continents, and we cannot go back to a time when the grape, both in its natural state or dried as raisins, and the juice, fermented and unfermented, were not largely used. For home use, and as a garden product, the grape can be advantageously cultivated as far north as Massachusetts. A grape arbor or trellis should be found on every farm where the nature of the soil does not absolutely preclude its growth. The vine is almost the only fruit-bearing plant which can be grown in the "yards" of city residences.

The grape is a rather perishable fruit, and, for market purposes, cannot be grown on our Atlantic slope north of the latitude of Pennsylvania and Southern New York. But, going westward to the region of the great lakes, we find a considerable vine-growing region in some islands at the western extremity of Lake Erie, and another on the eastern shore of Lake Michigan. Leaving the great lakes, which greatly moderate the climate of their shores, we find the next vine-growing region in Southern Ohio, Illinois, and Missouri, whence it stretches, where the soil itself is favorable, to the extreme southern boundary of the United States. Besides grapes themselves, considerable quantities of wine are produced in this grape-growing region.

The soil best adapted for the vine is a light or even sandy loam, provided that it is rich in certain mineral elements, especially potash. Soils containing much lime and magnesia are also favorable. The vine sends its roots very deeply down, and hence very little danger to it is to be apprehended from drought, in any part of the United States. It flourishes without irrigation in the comparatively rainless climate of California. An excess of moisture is its great natural enemy, and hence thorough and deep underdraining is indispensable. The vine draws heavily upon the soil for its potash, which, in the processes of wine-making, is deposited, by fermentation, in the form of "cream-of-tartar" (bicarbonate of potassa); hence all the residuum, after the juice has been expressed, the lees which are not manufactured into cream-of-tartar, the pommage, stems, prunings, etc., should be returned to the soil. Potassic manures and fertilizers, such as wood-ashes, are, moreover, indispensable. There are, however, few regions (and these are rapidly diminishing) where wood-ashes are available; but there are minerals, notable among which is the glauconite, found in the green-sand region of New Jersey and elsewhere, which afford an inexhaustible supply of potash for fertilizing purposes. Bones, also—especially in the form of bone-dust—form an excellent fertilizer for the vine.

The vine is propagated mainly by cuttings from the last year's canes; but seedlings are also grown, in order to obtain new varieties, and some very choice ones have been obtained by hybridization. Some of the most valuable of our American varieties appear to have resulted from mere accident. Circumstances, perhaps, of soil and climate, for which we have as yet no explanation, not unfrequently exert a great influence upon not only the growth and productiveness of different varieties of the vine, but upon the quality of the fruit. Of two neighboring vineyards, with apparently the same soil, and stocked with the same cuttings, one will often produce the best wine, and the other that of a very inferior quality. In our present state of knowledge upon the subject the vine-grower must, to a great extent, be guided by his own experience and that of others. Science, it is to be hoped, will before long come to the aid of the practical vine-grower. But, in any case, there is no department of agricultural enterprise and industry in which sound judgment is more required, or in which larger rewards may be looked for, than in that of vine-growing.

By a long course of artificial production and cultivation, and especially by severe pruning, the vine of Europe has in a great degree lost its character of a climbing plant. A French or German vineyard presents to the eye the appearance of a field planted with dwarfed shrubs. It seems probable that some of the chief diseases which have of late years proved so fatal to the vineyards of France and Germany are partly the result of this mode of propagating the vine, generation after generation, from the cuttings, instead of renewing the stock from the seed. It is certain that the European vine is quite unable to withstand the attacks of a new enemy. In 1853–54 the vines in Spain, Portugal, France, and Germany were simultaneously attacked by a minute fungous growth—the *oïdium*, which to the eye resembles a mildew—and which caused extensive ravages. This was essentially an epidemic, and in time subsided.

Ten years later the French vines were attacked by a disease to which the name of "root-rot" was given, it being supposed to be a mere decay of the root. It was not until 1868 that it was discovered to be occasioned by the attacks of the minute, wingless louse to which the name of *phylloxera* has been given. It was also found that this insect was brought into Europe from America in the cuttings of vines which had been imported for the purpose of introducing new and more hardy stock. So great were the ravages of the phylloxera that the French Government in 1872 offered a reward of 300,000 francs for the discovery of any remedy. It is said that within the last eight or ten years France has lost more than a million acres of vines by this pest.

But the thing of special interest is that, while this American phylloxera is so destructive to European vines, it does, as yet, little or no harm to most of our native varieties, which thus far seem to be "phylloxera-proof." Various remedies have been tried in Europe, but with hardly an appearance of success. There is now a large exportation of American cuttings, for grafting on European varieties. The bearing of this, from a wealth-producing point of view, will be appreciated when we consider the present condition and future prospects of wine-making.

WINES.—Important as the vine is as the bearer of grapes to be consumed as fruit, its chief importance has hitherto arisen from the production of wine. The possible value of the wine product of Europe, and inferentially of America, must be estimated, not by the quantity now produced, but by what was made (or manufactured) twenty years ago, before the oïdium and the phylloxera had cut down the area under cultivation and the yield of wine. Mr. Haraszthy, one of the earliest, and still one of the most extensive, vine-growers of California, was appointed, in 1861, commissioner from that State to investigate the vine-culture of Europe. He furnishes full statistics upon the subject, the essential points of which are given in Table VIII. The acreage is from public sources; the quantity of wine produced is the average for several years, as calculated by Rewald. In estimating the value of the product it is put at 25 cents a gallon, that being assumed as the average sum received by the actual producers on the spot. It will be seen that at this low estimate the value of the wine crop of Europe for one year was $776,000,000, exceeding by more than one-half the value of any crop in the United States in 1880:

TABLE VIII.—WINE PRODUCT OF EUROPE.

COUNTRY.	Vineyards.	Product of Wine.	Value of Wines.	Product per Acre.	Value per Acre.
	Acres.	*Gallons.*	*Dollars.*	*Gallons.*	*Dollars.*
France	5,013,774	884,000,000	221,000,000	176.3	44.07
Italy	2,887,970	1,275,000,000	318,750,000	441.5	110.37
Austria	2,685,950	714,000,000	178,500,000	265.8	66.46
Spain	955,004	144,500,000	36,125,000	151.7	37.92
Germany	350,338	52,105,000	13,026,250	150.0	37.02
Greece	77,593	9,384,500	2,346,000	115.0	28.68
Switzerland	76,400	2,550,000	637,500	33.5	8.34
Total	12,285,780	3,107,039,000	776,759,750	......	......

It is not probable—nor, indeed, desirable—that wine-making should assume with us anything like the proportionate importance which it holds in these European countries; but in California, at least, grape-growing for this purpose is a rapidly-increasing industry. Except in California, the vine is grown almost entirely in small patches of ground; there are no means of giving, even approximately, any reliable estimate of the acreage devoted to it. With respect to California, however, Mr.

Nordhoff furnishes us with some facts of more recent date than our last census. He says that in 1882 there were in that State 85,000 acres planted in vines, of which 20,000 acres were new, and had not borne; and that in 1880 the total vineyard product of the State—grapes for market, wine, and raisins—was valued at more than $3,000,000. He says:

"It is clear that this industry is still but in its infancy in this State, and that it has a wide and lasting future. One hears on all hands, and in a dozen counties, of men of wealth planting out from one hundred to one thousand acres in vines as a profitable and permanent investment. For my part, I do not believe that these great vineyards will, in the long run, be profitable. The vine needs more care than will be given to it in these large vineyards, where the owner's eye is absent, and must be replaced by careless foremen and uninterested laborers. The small vineyards will be the profitable ones, and the possessor of forty or even twenty acres will secure a handsome profit, and keep his vines strong and healthful, while the vines on the great estates will slowly perish, and never bear satisfactorily. It is the small vineyards in the foot-hills of the Sacramento Valley which will some day bear off the great prizes, and become permanently valuable properties. Fortunately for men of small means coming here, these lands are still the cheapest in the State. Land of approved quality for vineyards can be bought at various prices, from $5 to $100 per acre. In those counties where the culture has been long established the prices are the highest; but there is much land capable of producing the very best quality of wine which can still be obtained for from $5 to $10 per acre, and in small or great quantities."

As now conducted in California, the business of wine-making is quite separate from that of grape-growing. "Wineries" have been established, having presses which will stem and crush from eight to ten tons of grapes per hour, without the fruit being touched by human hand or foot after it has been picked. In the cellars of these establishments are vats holding three thousand gallons each, and sometimes four times as much. The grape-grower sells his grapes to these wineries in the bulk. As to the prices, Mr. Nordhoff says:

"The price of grapes, as with other crops, varies from year to year. In 1879 'Mission grapes' brought at the wine-centres from $14 to $16 per ton; finer varieties, from $18 to $26 per ton. Wine-makers complain that the prices of 1879 were too high. I have no doubt that they were, and that prices will, as a rule, be considerably lower than these. Nevertheless, in this year (1881) prices are well maintained. In Sonoma, Napa, and Stockton, Mission grapes—the common grape of the country, now chiefly used for brandy and heavy wines—brought $25 per ton in autumn; foreign varieties, $30; Zinfandel, from which claret is made, $30 to $32; and Riesling, the grape for white wines and champagnes, $30 to $35 at the wineries. In the Los Angeles country $20 per ton was paid for Mission and $25 for foreign grapes; and similar prices in other parts of the State. It is reckoned that a vineyard should bear four tons to the acre. I should think three and a half tons a fair crop; but in many considerable districts this average is largely exceeded, and from eight to ten tons per acre is not an uncommon crop where irrigation is practised."

Mr. Nordhoff first visited California in 1872, and then expressed himself not very favorably in regard to wine-making. His views were much modified by his second visit, in 1881. He now says:

"In the early days, and indeed until quite recently, the owner of a vineyard was obliged to have also a cellar, casks, presses, and needed, therefore, a considerable capital—more than a farmer usually has. And there is no doubt that while this worked badly and oppressively upon the vine-growers, it also made vine-culture a business by which many a poor farmer and his boys became sots. It is not good for anybody to spend much time in a wine-cellar; and I then advised new settlers not to plant vineyards, because having to make wine would expose many of them to contracting habits of intemperance and tippling. The great change which has come about in the management of the business avoids this danger. The farmer who sells his grapes to a wine-maker has no more temptation to wine-bibbing than if he sold grain to the mill."

But, whatever may be thought of the extended culture of the vine for wine-making, there can be no question that its extension for the sake of the fruit itself, whether to be used in its natural state or dried, as raisins, is very certain.

Raisins.—The raisin is not simply any dried grape, but is the product of certain varieties of the grape dried and treated in a particular manner. Hitherto the raisins of commerce have been produced almost entirely within narrow districts in Spain, Italy, Sicily, and some of the Grecian islands. What are known among us as "dried currants" are really raisins made from a variety of the grape, the fruit of which is not larger than a pea, and the clusters only about three inches long. The best raisins imported come from Spain, and are commonly known as "sun-raisins." These are dried upon the vine; when the grape is ripe the stem is twisted or partly severed, and the fruit begins to shrivel from the evaporation of the water, while all the saccharine matter and other elements are retained. The more common kinds of raisins, after being picked, are dried either in the sun or in heated rooms; they are then dipped in a strong lye, in which a little oil is mixed, which causes an exudation of saccharine matter which concretes upon the raisins.

Theoretically it has long been believed that California must be specially adapted for the production of raisins, both because the grapes best adapted for this use flourish there and because the climate is fitted for drying them. But raisin-making is an altogether new industry there. Nordhoff says:

> "Ten years ago California produced in limited quantities an article called 'dried grapes,' which was sold in the mining-camps and among the poor as a cheap substitute for raisins. They would not keep, would not bear transportation, were not soundly cured, and, in short, were not raisins. The product was of no commercial importance. Two years ago (1879) the raisin-product of California amounted to perhaps $200,000. Next year (1882) it will be worth $500,000; and, unless for some reason not yet apparent it receives a check, California will in ten years supply a large part of the raisins of commerce. It is one of the most promising and important of the industries recently introduced into this State."

The Gordo Blanco is the raisin-grape of California, as it is also of Spain; it is also the most delicious of table-grapes. "It has," says Nordhoff, "been used as a wine-grape, and is still used in the production of brandy, but it will now and for many years to come be cultivated for raisins." From Mr. Blower, one of the earliest and still the largest raisin-maker in the State, Nordhoff received much minute and valuable information, which we summarize.

He practises the most careful cultivation of his vineyards, going over the ground as many as sixteen times a year with various implements, in order to keep the soil loose and mellow, and perfectly free from weeds. He also—contrary to general usage in respect to the vine—makes free use of irrigation, even keeping the vines under two feet of water for nearly four weeks during the winter. He also makes large use of bone-dust and ashes, but finds stable-manure not adapted to this vine. The average product of his vineyard for the six years, 1876–82, was six tons of grapes to the acre, equivalent to two tons of marketable raisins. He considered, as the result of his own experience and observation of that of others', that a vineyard of raisin-grapes, carefully cultivated and irrigated, should yield in the third year enough to repay all the cost of labor for that year, including the picking; that in the fourth year it should repay the entire cost of the land, and planting and culture up to that time. But, says Nordhoff, "it is well known that a vine is not in full bearing until the seventh or even the tenth year after planting. To plant and cultivate a raisin-vineyard should cost, to the time of bearing, not less than $40 per acre—probably more—exclusive of picking and curing the grapes."

Mr. Blower, who had made raisins where they yielded a dollar for every vine—of which there were usually 550 to the acre—thought that "good raisin-land, with water secured, would be reasonable in price at from $80 to $100 per acre." But, in Nordhoff's judgment, "this should include such nearness to market as his own neighborhood," which was in Yolo County, seventy-five miles from San Francisco, and on the line of the Central Pacific Railroad. But he adds: "There is a vast quantity of good land in the southern part of the State, obtainable and suitable for this crop, at from $20 to $50 per acre, with water secured; and without water-ditches, but lying in large tracts, where a body of settlers could bring water by a united effort, such lands can be got at from $5 to $10 per acre, in parts where both climate and soil are most favorable for the raisin-crop."

Until the autumn of 1881 nearly all farmers who cultivated raisin-grapes made their own raisins. The process is by no means a complicated one. The sun being the best dryer, artificial drying, whenever resorted to, produces a poorer quality of raisins. The bunches are cut from the vine, defective grapes carefully picked off, and the clusters laid to dry either upon the ground or upon wooden trays about three feet square. In the opinion of some growers it is better to lay the clusters upon the ground, the heat retained by the soil, they say, helping the drying during the cool nights. When the upper side of the bunches is tolerably dry they are turned with as little handling as possible. Only one turning is required; but in localities liable to sea-fogs or rain the grapes should be covered at night.

But when sufficiently "cured" the grapes will be unequally dried. At the proper stage they are brought into the house and placed in boxes four feet square and two and a half or three feet deep. They remain in these "sweat-boxes" from one day to five, until the moisture has equally permeated the whole mass — the drier portions receiving moisture from the others, and *vice versâ*. The grapes have now become raisins, and are packed for market. A division of labor is beginning to be introduced into raisin-making. Here and there a farmer sells his grapes on the vine to men who undertake the business of drying and packing; others dry their grapes, and sell them in this state to professional packers. Mr. Nordhoff thinks "it is probable that as the planting of the raisin-grape becomes more general in the southern half of the State, where the climate and soil especially favor it, the farmers will be able to dispose of their raisin-grapes, either in the field or dried, to men who will make a business of drying or packing them."

In this and the preceding chapter special attention has been given to California, for the reason that this State presents some characteristics distinguishing it from most other portions of the Union, and which afford special inducements to those who seek new homes for themselves. It should be borne in mind, also, that California is a very large State; territorially, indeed, an empire. Its area exceeds by one-third that of Great Britain and Ireland or Italy. It is nearly equal to that of the kingdoms of Great Britain, the Netherlands, Belgium, and Denmark combined. It is less by only one-fourth than that of France or Germany; by one-half than that of Austria and Hungary. It is undoubtedly capable of sustaining a population equal to that of either of the great Powers of Europe, with the exception of Russia, and perhaps of Germany; and generations must elapse before it will become so thickly peopled as not to afford scope for enterprise, skill, and industry.

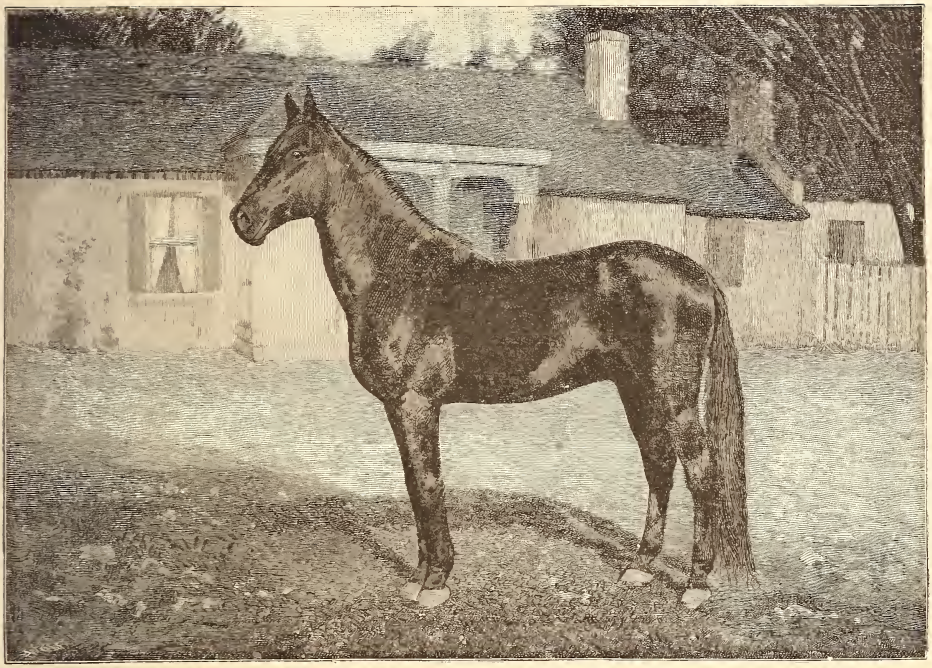
CHAPTER X.

LIVE-STOCK, AND ITS OPPORTUNITIES.

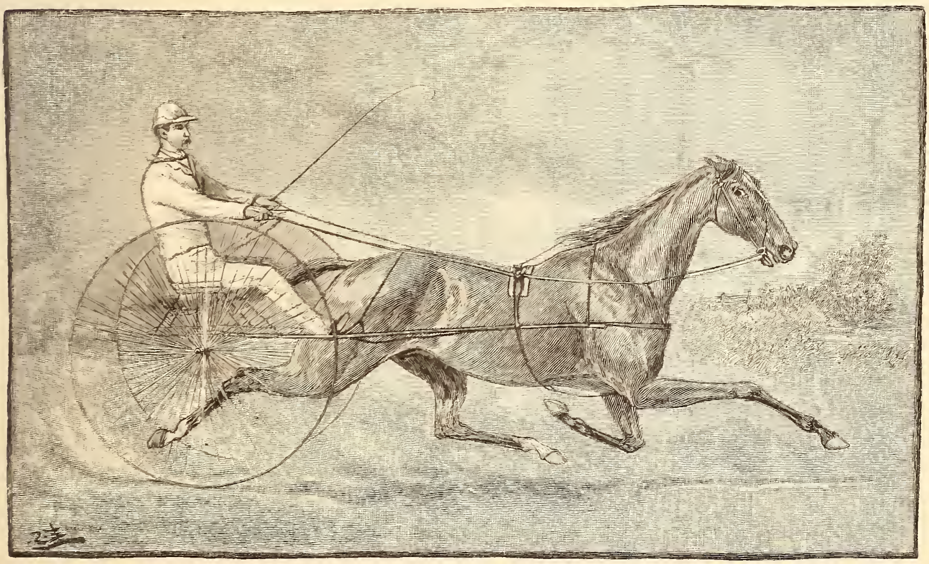
THE raising of live-stock is a very important department of husbandry. A large proportion of farmers and planters are also stock-raisers to a greater or less extent, and most of those largely engaged in the raising or care of live-stock are also directly engaged in agriculture. In the Census Report these are classed as farmers, planters, or agricultural laborers. Still, there are in the United States 44,075 persons who are specifically designated as "stock-raisers," "stock-herders," and "stock-drovers." Of these only 2793 are under the age of sixteen; and there are only 226 women, of whom 122 are "stock-raisers;" that is, the proprietors of stock-raising farms.

The Census of 1880 takes no account (except in regard to sheep) of the live-stock not upon farms. This is very considerable; for, according to the Census of 1870, there were in that year 23,800,000 neat-cattle on farms, and 4,273,000 not on farms; and 7,142,000 horses on farms, and 1,547,000 not on farms. The number of neat-cattle not on farms is now comparatively small, as the public lands upon which they formerly grazed have been mostly bought up by the graziers, and the cattle transferred to farms, being so included in the Census of 1880.

But the horses "not on farms" include, and indeed mainly consist of, those employed for draught or riding in cities and towns, and are thus not included in the Census. How important this exclusion is will appear from a few instances. The county of New York is, territorially, the same as the city of New York, and contains only a few score of farms; the number of horses in the county is put down at only 207; whereas, the



ALMONT.



RARUS

See Note 4.

number actually employed for drawing the public conveyances, for trucking, driving, and riding, must be many scores of thousands. Kings County, on Long Island, includes the city of Brooklyn and five outlying farming townships; the number of horses in the county is given as only 1673, whereas there are probably one-third as many as in the city of New York. Philadelphia County, in Pennsylvania, is municipally the same as the city, but contains a considerable number of farms. The number of horses in the county is given as only 2763, whereas there are doubtless half as many as in the city of New York; and so on, to a greater or less extent, with all other cities and towns. The Superintendent of the Census appointed a special agent to inquire into the number of sheep not on farms; it would have been of great advantage had this been done in the far more important matter of horses. In the absence of all specific data bearing upon this point, it may be assumed that the number of horses "not on farms" was certainly not less in 1880 than it was in 1870; and as there were then more than a million and a half of these, at least so many should be added to the number of horses as given in the Census Report.

Table IX. gives for each State the number of heads of live-stock in 1880 and 1870.

In considering, for practical purposes, the increase from one decade to another in any branch of production, respect must be had not so much to the absolute increase as to the ratio which it bears to the increase of population. If any production has increased by a percentage much less than that of the increase of population, that industry is relatively a declining one; and, as a rule, a declining industry furnishes less prospect of success than a growing one. There will, of course, be many cases in which a stated industry, though not successful in some sections of the country, may be profitably conducted in other sections. Thus, for example, the raising of peaches has been practically abandoned everywhere north of Southern New York, while it has become exceedingly profitable in Maryland, Delaware, and parts of New Jersey, and probably may be so still farther south.

The raising of live-stock is among the growing industries of the United States, as is shown by the fact that the ratio of increase of every kind during the last decade was considerably greater than that of the increase of population; and there is

TABLE IX.—LIVE-STOCK.

States and Territories.	1880. Horses.	1870. Horses.	1880. Mules and Asses.	1870. Mules and Asses.	1880. Work'g Oxen.	1870. Working Oxen.	1880. Milch Cows.
Alabama	113,950	80,770	121,081	76,675	75,534	59,176	271,443
Arizona	6,798	335	891	401	984	587	9,156
Arkansas	146,333	92,013	87,082	36,202	25,444	35,387	249,407
California	237,710	192,273	28,343	17,533	2,288	5,944	210,078
Colorado	42,257	6,446	2,581	1,173	2,080	5,566	288,770
Connecticut	44,940	34,935	539	190	28,418	39,639	116,319
Dakota	41,670	2,514	2,703	225	11,418	2,125	40,572
Delaware	21,933	16,770	3,931	3,584	5,818	6,888	27,284
Dist. of Columbia	1,027	533	68	124	4	6	1,292
Florida	22,636	11,902	9,606	8,835	16,141	6,292	42,174
Georgia	98,520	81,777	132,078	87,426	50,026	54,332	315,073
Idaho	24,300	2,151	610	371	737	522	12,838
Illinois	1,023,082	853,738	123,278	85,075	3,346	19,766	865,913
Indiana	581,444	497,883	51,780	43,259	3,970	14,088	494,944
Iowa	792,322	433,642	44,424	25,485	2,506	22,058	854,187
Kansas	430,907	117,786	64,869	11,786	16,789	20,774	418,333
Kentucky	372,648	317,034	116,153	99,230	36,166	69,719	301,882
Louisiana	104,428	59,738	76,674	61,338	41,729	32,596	146,454
Maine	87,848	71,514	298	336	43,049	60,530	150,845
Maryland	117,796	89,696	12,561	9,830	22,246	22,491	122,907
Massachusetts	59,629	41,039	243	103	14,571	24,430	150,435
Michigan	378,778	228,302	5,083	2,353	40,393	36,499	384,578
Minnesota	257,282	93,011	9,019	2,350	36,344	43,176	275,545
Mississippi	112,309	90,221	129,778	85,886	61,705	58,146	268,178
Missouri	667,776	493,969	192,027	111,502	9,020	65,825	661,405
Montana Territory	35,114	5,289	858	475	936	1,761	11,308
Nebraska	204,864	30,511	19,999	2,632	7,234	5,931	161,187
Nevada	32,087	7,520	1,258	990	765	2,443	13,319
New Hampshire	46,773	39,095	87	37	29,152	40,513	90,564
New Jersey	86,940	79,708	9,267	8,853	2,022	3,830	152,078
New Mexico Ter.	14,547	5,033	9,063	6,141	16,432	19,774	12,955
New York	610,358	536,861	5,072	4,407	39,633	64,141	1,437,855
North Carolina	133,686	102,763	81,871	50,684	50,188	45,408	232,133
Ohio	736,478	609,722	19,481	16,065	8,226	23,606	767,043
Oregon	124,107	51,702	2,804	2,581	4,132	2,441	59,549
Pennsylvania	533,587	460,339	22,914	18,009	15,062	30,048	854,156
Rhode Island	9,661	7,770	46	43	3,523	5,821	21,460
South Carolina	60,660	44,105	67,005	41,327	24,507	17,685	139,881
Tennessee	266,119	247,254	173,498	102,983	27,312	63,970	303,900
Texas	805,606	424,504	132,447	61,322	90,502	132,407	606,176
Utah Territory	38,131	11,068	2,898	2,879	3,968	3,479	32,768
Vermont	75,215	65,015	283	252	18,868	27,809	217,033
Virginia	218,838	152,899	33,598	26,903	54,709	45,987	243,061
Washington Ter.	45,848	11,138	626	943	3,821	2,181	27,622
West Virginia	126,143	90,479	6,226	2,139	12,643	18,937	156,956
Wisconsin	352,428	252,019	7,136	4,195	28,762	53,615	478,374
Wyoming Ter.	11,975	584	671	283	718	922	3,730
Total	10,357,488	7,145,370	1,812,808	1,125,415	993,841	1,319,271	12,443,120

every reason to anticipate that this ratio of increase will be kept up.

An analysis of the figures in Table IX. will produce the following results, among others: The increase of population

TABLE IX.—LIVE-STOCK—*Continued.*

States and Territories.	1870. Milch Cows.	1880. Other Cattle.	1870. Other Cattle.	1880. Sheep.	1870. Sheep.	1880. Swine.	1870. Swine.
Alabama....	170,640	404,213	257,347	347,538	241,934	1,252,462	719,757
Arizona.....	938	34,843	3,607	76,524	803	3,819	720
Arkansas...	128,959	433,392	193,589	246,757	161,077	1,565,098	841,129
California...	164,093	451,941	461,361	4,152,349	2,768,187	603,550	444,617
Colorado....	25,017	315,989	40,153	746,443	120,928	7,656	5,509
Connecticut.	98,889	92,149	79,485	59,431	83,884	63,699	51,983
Dakota.....	4,151	88,825	6,191	30,244	1,901	63,394	2,033
Delaware...	24,082	20,450	19,020	21,967	22,714	48,186	39,818
Dist. of Col.	657	271	138	....	604	1,132	577
Florida.....	61,922	409,055	322,701	56,681	26,599	287,051	158,908
Georgia.....	231,310	544,812	412,261	527,589	419,465	1,471,003	988,566
Idaho.......	4,171	71,292	5,763	27,326	1,021	14,178	2,316
Illinois.....	640,321	1,515,063	1,055,499	1,037,073	1,568,286	5,170,266	2,703,343
Indiana.....	393,736	864,846	618,360	1,100,511	1,612,680	3,186,413	1,872,230
Iowa.......	369,811	1,755,343	614,366	455,359	855,493	6,034,316	1,353,908
Kansas.....	123,440	1,015,935	229,753	499,671	109,088	1,787,969	206,587
Kentucky...	247,615	505,746	382,993	1,000,269	936,765	2,225,225	1,838,227
Louisiana...	102,076	282,418	200,589	135,631	118,602	633,489	338,326
Maine......	139,259	140,527	143,272	565,918	434,666	74,369	45,760
Maryland...	94,794	117,387	98,074	171,184	129,697	335,408	257,893
Mass........	114,771	96,045	79,851	67,979	78,560	80,123	49,178
Michigan...	250,859	466,660	260,171	2,189,389	1,985,906	964,071	417,811
Minnesota...	121,467	347,161	145,736	267,598	132,343	381,415	148,473
Mississippi.	173,899	387,452	269,030	287,694	232,732	1,151,818	814,381
Missouri....	398,515	1,410,507	689,355	1,411,298	1,352,001	4,553,123	2,306,430
Montana Ter.	12,432	160,143	22,545	184,277	2,024	10,278	2,599
Nebraska...	28,940	590,129	45,057	199,453	22,725	1,241,724	59,449
Nevada.....	6,174	158,137	22,899	133,695	11,018	9,080	3,295
N. H........	90,583	112,689	91,705	211,825	248,760	53,437	33,127
New Jersey.	133,331	69,786	60,327	117,020	120,067	219,669	142,563
N. Mex. Ter..	16,417	137,314	21,343	2,088,831	619,438	7,857	11,267
New York..	1,350,661	862,233	630,522	1,715,180	2,181,578	751,907	518,251
N. Carolina..	196,731	375,105	279,023	461,638	463,435	1,453,541	1,075,215
Ohio........	654,390	1,084,917	758,221	4,902,486	4,928,635	3,141,333	1,728,968
Oregon.....	48,325	352,561	69,431	1,083,162	318,123	156,222	119,455
Penn........	706,437	861,019	608,066	1,776,598	1,794,301	1,187,968	867,548
Rhode Island	18,806	10,601	9,748	17,211	23,938	14,121	14,607
S. Carolina..	98,693	199,321	132,925	118,889	124,594	628,198	395,999
Tennessee...	243,197	452,462	336,529	672,789	826,783	2,160,495	1,828,690
Texas.......	428,048	3,387,927	2,933,588	2,411,633	714,351	1,950,371	1,202,445
Utah Ter....	17,563	58,680	18,138	233,121	59,672	17,198	3,150
Vermont....	180,285	167,204	112,741	439,870	580,347	76,384	46,345
Virginia....	188,471	388,414	277,285	497,289	370,145	956,451	674,670
Wash. Ter...	16,938	103,111	28,135	292,883	44,063	46,828	17,491
W. Virginia.	104,434	288,845	178,309	674,769	552,327	510,613	268,031
Wisconsin..	308,377	622,005	331,302	1,336,807	1,069,282	1,128,825	512,778
Wyoming T.	707	273,625	9,501	140,225	6,409	567	146
Total.....	8,935,332	22,488,550	13,566,005	35,192,074	28,447,951	47,681,700	25,134,569

from 1870 to 1880 was 30.1 per cent., and this is assumed as the basis of comparison. The increase during the same period in the number of neat-cattle was 38 per cent.; in the number of horses, 44 per cent.; in the number of mules, 61 per cent.; in the number of sheep, 48 per cent.; in the number of swine, 90 per cent. Or, taking all together, the increase in the number of live-stock was 56.2 per cent.—a ratio of increase almost twice that of the increase of population.

The increase in values is even greater than the increase in numbers. The statistics embodied in the censuses of 1880 and 1870 show that not only has the number of live-stock more than doubled during that period, but that the average value of each head has also nearly doubled.

The average value per head for the whole United States, in 1880, was: Mules, $61.26; horses, $54.75; milch cows, $23.27; oxen and other cattle, $16.10; swine, $4.28; sheep, $2.21. Multiplying these values by the number of the respective kinds of live-stock, we find their total values to be, in round numbers: Horses, $647,000,000; oxen, $384,000,000; milch cows, $290,000,000; swine, $204,000,000; mules, $111,000,000; sheep, $93,000,000: total value of live-stock, $1,729,000,000.* The Census Report of 1870 gives the total value of "all live-stock" in that year (in gold) as about $1,050,000,000; but from this should be deducted about $175,000,000 for the live-stock "not on farms," which are not included in the Census of 1880; so that there was in 1880 an increase of value of about $679,000,000, or 66 per cent. While there is no reason to suppose that the increase in the numbers of live-stock will hereafter be less in proportion to the increase of population, it is not probable that the increase in value per head will hereafter be as great as it was from 1870 to 1880. But there must still be an increase in the value per head, owing to the improvements in the breeds of some of the animals, especially of neat-cattle. There can be no doubt that the numbers of cattle will

* The Census Report puts the value of live-stock "on farms" at $1,500,464,609, thus leaving about $229,000,000 for that "not on farms."

increase more rapidly than the population increases; for, besides our home consumption, Great Britain must look very largely, and France and Germany considerably, to the United States to supply their inevitable and growing deficiency in meat as well as in bread-stuffs. Great Britain may get nearly all her wool from Australia and New Zealand; she may possibly, in time, draw much of her salted and canned meats from these colonies; but there is no present probability that fresh meat can be profitably brought from them; for such meats would have to be carried over the whole breadth of the tropical zone and over two-thirds of both temperate zones, in order to reach England — a three months' voyage at least, instead of the eight or ten days consumed between New York and Liverpool.

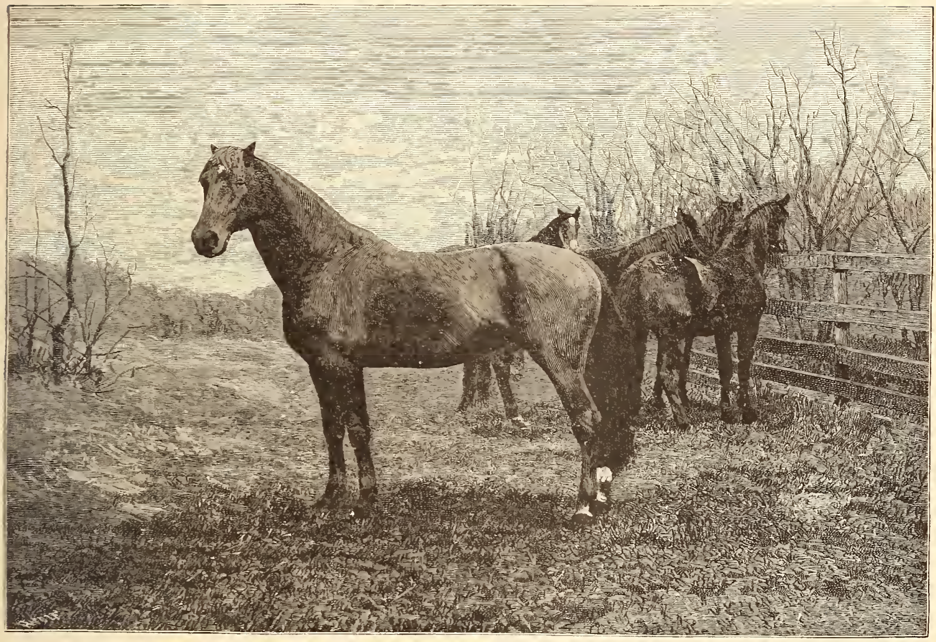
Every part of an animal is of value for one purpose or another, and the utilizing of such portions as were formerly wasted is among the chief triumphs of recent science and skill. The hides of all (except the swine, which is rarely skinned) are used for leather; the hoofs and horns for various manufacturing purposes, and for making glue; the bones, besides manufacturing uses, furnish gelatine, which is largely used as an ingredient of soups, although some eminent physiologists affirm that this gelatine is of very little value as nutriment, while others, not less eminent, claim a very high value for it. When calcined in close vessels bones yield "bone-black," or animal charcoal, an indispensable article in the refining of sugars. Bones, especially when pulverized into "bone-dust," are among the most valuable of fertilizers, and are almost indispensable for some crops. The offal and excreta of animals form the most common manures. The fat of all animals is of great value for many purposes, among the most important of which are: for cooking, for the manufacture of soap and candles, and for lubricating machinery. For the last three purposes the supply of animal fats is altogether insufficient, and the deficiency is supplied by various vegetable oils, especially palm-oil, and by mineral oils, such as petroleum. Still, the most important uses of live-stock are, their flesh (except that of the horse and mule), for food; dairy products — milk, butter, and cheese — from the cow; and wool, from the sheep. These will be considered in connection with the different animals which furnish them.

NEAT-CATTLE. — In respect of value — both of the animals themselves and of their products—cattle rank highest among our live-stock, although in number they are exceeded by both sheep and swine. A considerable number of cattle are still used as "working oxen;" but during the last twenty years their number has been constantly decreasing, not merely as compared with the increase of the population, but absolutely. In 1860 there were in the United States 2,254,911 working oxen; in 1870 there were 1,319,271; in 1880 there were 993,841—an absolute decrease from 1860 to 1870 of 42 per cent.; and from 1870 to 1880 there was a farther decrease of 25 per cent. In 1880 there were, indeed, 44 per cent. fewer working oxen than there were in 1850, notwithstanding an increase of 117 per cent. in the population. In most sections of the country horses and mules have, to a great extent, taken the place of oxen in agricultural and field labor.

Milch cows constitute about 32 per cent. of the neat-cattle in the United States, the remainder being oxen and young animals. The average value of a milch cow is somewhat greater than that of the other cattle, and the value per head of all of them, for various reasons, varies in different localities. Thus, in 1880 the average value of a milch cow in Georgia was $13.25, of other cattle, per head, $7.90; in Tennessee a cow was $13.25, other cattle $7.90; in California, a cow, $28.50, other cattle, $18.50; in Ohio, a cow, $26.50, other cattle, $22.50; in New York, a cow, $29.10, other cattle, $26.25; in Massachusetts and Rhode Island the value per head was about equal, $35 in the former State and $30 in the latter. In Texas the average value of a milch cow was $14, of other cattle $9, per head; since then, however, the value of cattle in Texas has considerably increased, owing to better means of bringing them to market. The average value for the whole United States was about $25 for a cow and $16 per head for other cattle.

One reason for the greater value of cattle in some sections

CELEBRATED AMERICAN TROTTERS.



KING RENÉ.

ABERDEEN. ALMONT LIGHTNING.

ETHAN ALLEN, JUN. HAPPY MEDIUM.

See Note 4.

over others is the improvement in the breeds; and the raising of improved stock is frequently a very lucrative business, a cow or bull of the most approved breeds often bringing several hundreds, and sometimes several thousands of dollars. This business requires, however, great judgment and a very considerable capital, so that comparatively few can engage in it.

The Census of 1870 gives the value of all "animals slaughtered or sold for slaughter" as (in gold) $319,165,327. The Census of 1880 includes only the animals slaughtered in large establishments, "the statistics of retail slaughtering establishments not being included;" so that no comparison between the two periods can be instituted. The whole value of all the animals slaughtered in these wholesale establishments in 1880 was $256,738,905; that of beeves being $71,333,182, being less than half that of swine.

The products of the dairy—milk, butter, and cheese—far exceed in value that of the flesh of neat-cattle. These form the subject of the next chapter.

Sheep and Wool.—In the United States sheep are raised for the sake of their wool rather than for the sake of their flesh. As shown in Table IX., the number of sheep "on farms" in 1880 was 35,192,074; in 1870 there were on farms 28,477,951—an increase in 1880 of 24 per cent. There were also in 1880, according to estimate, 7,000,000 sheep on "ranches and public lands," making the whole number more than 42,000,000. As nearly as can be estimated, the proportion between those on farms and those not on farms was about the same in 1870 as in 1880. The wool product of sheep on farms in 1880 was 155,681,751 pounds; the Census Report of 1870 gives the product of that year as 100,102,387 pounds—an increase of 55 per cent. Besides the wool produced on farms, it was found, by special investigation, that in 1880 the fall clip in Texas and California, not included in the statement, was 13,000,000; the wool of other "ranch" sheep was 34,000,000, the pulled wool of slaughtered sheep 38,000,000 pounds—making the total wool product of 1880, 240,681,751 pounds.

There are no means of ascertaining even approximately the number and value of the sheep slaughtered. The Census Report of 1880 gives, as with beeves, only those killed in the 823 wholesale establishments. In these the number slaughtered was 2,233,701, their average gross weight being 92 pounds; value, $8,957,727, or $4 each. Of these sheep 80 per cent. were slaughtered in New York, Massachusetts, New Jersey, and California; and in twenty of the States there are none reported. But, besides these, the number of sheep slaughtered on the farm and in small slaughter-houses must be very considerable.

The average value of sheep per head throughout the United States is $2.21; but it varies considerably in different sections. In Alabama and Arkansas it is as low as $1.56; in California, $1.62; in Texas, $1.89; in Michigan, Ohio, and the adjacent States, about $2.70; in Vermont, $3.48; in New York and Massachusetts, $3.58; the highest rate being in New Jersey, where it is $4.07. In the sections where the value is much above the general average sheep are raised for slaughter quite as much as for their wool.

In Great Britain sheep are raised for their flesh rather than for their fleece, and careful breeding and careful feeding have produced breeds of great value for this purpose. Notable among these are the Southdowns, prized not only for their size, but for the quality of their mutton. Not long since Mrs. Phœbe Earl Gibbons visited the Southdown district, and describes the mode of sheep-raising there practised. She says:

"Merino sheep are not kept here, the carcass being of more value than the wool. This farm, which is not enclosed, feeds about 900 sheep, in three flocks, each flock having a shepherd and a dog. At night the sheep are folded, the fold being made of wattles, which can be moved from spot to spot each day, so that, one after another, every spot is manured. The farmers try to have some green food started by lambing-time, which begins about March 10. The ewes are brought into the yard and foaled; but are often sent out almost immediately after upon rye-grass or young rye. All this is the care of the shepherd, who has a very anxious time of it, rising in the night to see if all is right. The sheep feed at large upon the rye-grass, but are folded upon the rye, especially at night. In June the pasture is good enough to turn them out upon the downs. The lot of the shepherd is a severe one, for he is out every day in the year, Sundays included. When the winds blow on the downs he makes a screen of his cloak, hanging it on the furze-bushes or on the wattles. This is his shelter for the day when the rain-storms come up from the Channel."

Mrs. Gibbons gives some figures which show the results of sheep-raising in England: "A lamb fair has been lately held at which this farmer sold 300 lambs between four and five months old at an average price of 30 shillings, or about $7.50 each. These lambs are bought by farmers who are not breeders to be fattened for the market. I heard of a recent fair to which 17,000 lambs were brought." Thus, a Southdown lamb of four or five months old is worth to the English sheep-raiser nearly twice as much as a sheep, fattened for slaughter, is with us. And these lambs are not bought for immediate slaughter, but to be fattened for the market, their value being thus greatly enhanced. With us "lamb" is the rule, mutton the exception; in Great Britain mutton is the rule, lamb the exception.

The English mode of sheep-raising for the market may not probably be profitably carried out here to its full extent, and only very partially in the great sheep-raising sections, where land is cheap. But it is well worthy of consideration whether it might not be remunerative in the older States to pay more attention to raising sheep for the market as well as for the wool. Of course the farmer who undertakes this will select breeds adapted to that purpose; that is, those which attain a much greater weight than the ones usual among us.

The simple fact that the product of wool has, upon the whole, increased in a ratio greater than that of the increase of the population, shows that it is in so far a remunerative occupation. Taking into view only the wool produced upon farms, as given in the Census Reports, we find that the increase from 1870 to 1880 was 55 per cent.; being, as a whole, not quite twice that of the ratio of increase of the population. But in some wool-growing sections the percentage of increase is very much greater than that of the population; while in others it is very much smaller, and in some there has been not merely a comparative but an absolute decrease. A few data will show the sections in which experience teaches that wool-growing has been found to be profitable or unprofitable in comparison with other agricultural industries.

In Oregon the increase from 1870 to 1880 was 470 per cent.; in Texas, 400 per cent.; in Missouri, 100 per cent.; in Tennessee, 54 per cent.; in California, 47 per cent.; in Michigan, 33 per cent.; in Ohio (which in 1870 and 1880 produced more wool by half than any other State) the increase was 25 per cent.; in Pennsylvania, 29 per cent.; in Iowa the product of both years was about the same. In New York (which in 1870 produced more wool than any other State, except Ohio and California) there was in 1880 a decrease of 18 per cent.; in Vermont, a decrease of 11 per cent. The general result of all is, that when land comes to have a greatly increased value the growing of wool becomes unprofitable in comparison with other products. Agriculture and dairy products take its place to a marked extent.

Still, there are vast regions where unoccupied land is yet abundant, and where the climate is so mild that sheep can find their own food throughout the year; and there wool-growing upon a large scale will be profitable for years to come. And there is no reason to apprehend that these regions will soon be exhausted. If wool-growing shall be gradually superseded by other industries in California and Ohio, as it has been in New York and Vermont, there will still be left for it vast regions in Texas, Colorado, Oregon, New Mexico, and Dakota.

Swine.—Swine are useful solely for their flesh and their fat. Table IX. shows their numbers in each of the States in 1880 and 1870. In 1880 there were in the United States 47,681,700 swine—probably more than there are in all Europe. In 1870 there were 25,134,569—an increase in 1880 of 90 per cent.; their value, at $4.25 per head, being $202.657,620.

Swine are found in considerable numbers in every State of the Union, there being seventeen States in each of which are more than a million. They are numerous, compared with the population, in the group of Central, Western, and North-western States, in which Indian-corn is the great agricultural product.

CELEBRATED AMERICAN RUNNERS.

IROQUOIS.

FOXHALL WINNING THE GRAND PRIX.

See Note 4.

Iowa, Illinois, Missouri, Indiana, Ohio, and Kentucky contain fully 50 per cent. of all the swine in the United States. They are numerous also in several of the Southern States; Alabama, Arkansas, Georgia, Mississippi, North Carolina, and Texas having nearly 20 per cent. of the whole.

The slaughter of swine, more than of any other live-stock, is carried on in extensive slaughter-houses. In these, in 1880, there were 17,847,409 swine killed or bought dressed, their average gross weight being 248 pounds, and their value, when slaughtered and packed, $176,447,996, or $9.90 each. Of the products of swine, 506,077,052 pounds of pork were sold fresh; 859,045,987 pounds were salted. There were 1,122,742,816 pounds of bacon and ham, and 501,471,698 pounds of lard. Illinois takes the lead in this business, slaughtering about 6,000,000 swine, or more than one-third of the whole number. Ohio and New Jersey come next, each slaughtering about 1,500,000. Thus, more than half of the killing of swine in the Union is done in these three States, although only about one-third of the swine slaughtered in those States are raised there.

There can be no doubt that the business of raising swine must be an increasing one in all of the great corn-growing sections. Without it, indeed, the production of corn would be far less than it is, for probably much more than half of this grain is converted into pork, instead of being used directly as human food.

Horses.—The number of horses on farms in the United States in 1880 was 10,357,488; in 1870 there were 7,145,370—an increase in 1880 of 45 per cent. But the number in 1860 was 6,249,174—only 12 per cent. less than it was in 1870. This comparative decrease between 1860 and 1870 was owing to the waste occasioned by the civil war, which must, therefore, have cost the lives of fully a million of horses. This loss was very heavy in the Southern States. In Virginia, Georgia, North Carolina, South Carolina, and Tennessee there were, in 1870, 30 per cent. fewer horses than in 1860; and in 1880 there were still 18 per cent. fewer than in 1860. The South has not, therefore, in this respect, even yet recovered from the devastation of the civil war.

If to the number of horses on farms we add 1,500,000—the estimated number not on farms—there were in 1880 in the United States 11,857,488 horses, their value, at $55 each, being $652,846,840. The raising of horses must be a lucrative business. That of fine breeds in particular, though requiring a large capital, having proved itself very profitable to those who have been able to engage in it.

Mules and Asses.—The mule is the especial working animal in the South. Their number in 1880 was 1,812,808; in 1870 there were 1,125,415—an increase in 1880 of 62 per cent. The South suffered in these animals during the civil war, although not to such an extent as in horses. Their number in 1860 was a few thousand more than in 1870. Their great ratio of increase—more than double that of the population—and the price which they command is evidence of their being indispensable in the section to which they are specially adapted. Their average price, $61 per head, exceeds that of any other live-stock, and their total value is $110,581,288. Missouri, Kentucky, and Illinois are the great mule-breeding States, and the industry is a very lucrative one.

Poultry should, properly, be classed as live-stock. The raising of poultry for the flesh and the eggs is a very considerable branch of farming industry. There are very few farms upon which fowls are not kept, and the value of their flesh and eggs is large in the aggregate, although in each individual case it is so small that the Census takes no separate account of it, and precise statistics are unattainable. But there is no doubt that the value of the poultry and eggs consumed is greater than that of mutton. In the Census Report of 1840 the value of the poultry of the United States was estimated at $13,000,000. The population has more than trebled since that time, and if the ratio be assumed to be the same, the present value of poultry will be about $40,000,000. It is not probable that the raising of poultry on a very large scale by a single grower will be attempted, but as an adjunct for every farmer it is worth far more attention than it has received. Mr. Bement's *American Poulterer's Companion** was for a long time our most valuable authority on this subject. He gives the result of his own experience and that of others. That result is especially valuable, as showing, not what possibly, and under unusual conditions, might be attained, but what was actually attained under ordinary conditions. But within a few years such improvements have been effected in the breeds of poultry that the average number of eggs from each hen may be at least fifty per cent. more than were secured by this author, who thinks that "from 80 to 100 eggs per hen for a year would be a fair estimate for a number of fowls kept together." His own experience with such breeds as were then attainable, conducted through five years, is of decided practical value. He says:

"The first year I had 100 hens, which were suffered to run at large, and I got but a little more than 1000 eggs. The second year my hens commenced laying on the 7th of February, and between that period and the 15th of August, when they commenced to moult, I obtained 2655 eggs from 60 hens. The third year they commenced laying on the 8th of January, and continued laying until the 27th of September, when they ceased entirely, but commenced again on the 13th of October, and continued to lay until the 18th of November, when they ceased, and commenced again on the 1st of December; and up to the 1st of January they produced more than 4000 eggs. The fourth year I had 71 hens, which produced within the year 3509 eggs. The fifth year I kept 60 hens, and obtained 3978 eggs."

Mr. Bement treats fully of the management of fowls and of the food best adapted to them. He says:

"Poultry, when well managed, might be of great profit to the farmer; but where many are kept they ought not to be allowed to go at large. In that case little or no profit can be expected, for not only will many of the eggs be lost, and many of themselves, perhaps, be destroyed by vermin, but at many seasons they do much mischief in the barn-yard and the field. It is thought that poultry ought always to be confined; but if so, instead of a close, dark, diminutive hovel, they should have a spacious, airy place, properly constructed. But, whether confined or suffered to run at large, there should always be a poultry-house and yard where they can be regularly fed. If possible, it should be on the south or south-east side of a hill or bank, so that one side of the wall may

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* *The American Poulterer's Companion.* By C. N. Bement.

be set against the side of the hill, and, if of stone, to be laid on mortar, which will add very much to the warmth of the room. It would be well, when building the wall, to leave holes or recesses some fifteen inches square, in which shallow boxes or drawers may be placed for the nests; these drawers can be removed when necessary, and cleaned and freed from vermin.

"The poultry-house should be neither too cold in winter nor too hot in summer, and should be made so attractive to the hen as to prevent her from laying her eggs in any other place. The extent of the place should be proportioned to the number of fowls to be kept in it; but it will be better too small than too large, particularly in winter, for the mutual imparting of electricity and animal heat; and it has been found when fowls are kept apart they are much less prolific.

"The driest and warmest soils are best adapted to the successful rearing of domestic fowls. They endure extreme cold much better than they do moisture, and the poultry-yard should neither be wet nor exposed to cold winds. There should, if possible, be running water in it; and under cover should be placed ashes or dry sand, where they may indulge in their natural proclivity of rolling and basking or bathing themselves. Gravel, broken shells, crushed bones, and old lime mortar should always be placed within their reach."

We condense some of the more important directions given in respect to the food of fowls:

"Every alimentary substance, even when buried in manure, agrees with fowls, and nothing is lost by them. The smallest seed cannot escape their piercing eye; the fly, most rapid of flight, cannot avoid the promptitude with which she darts her bill; the worm that comes up to breathe at the surface of the ground has not time to shrink back before it is caught by the head and drawn up.

"It is customary to throw to fowls in a poultry-yard, once or twice a day, a quantity of grain somewhat less than they would consume if they had an abundance. But they are more easily satisfied than might be supposed from the voracity which they exhibit when fed by hand. It has been found that there is considerable economy in feeding wheat, corn, and barley well boiled, as the grain is thus increased in bulk one-fourth, and the same bulk seems to satisfy them; but there is no saving in boiling oats, buckwheat, or rye. Potatoes are an excellent and economical article for feeding fowls; but if they are fed upon them alone, without grain, they are apt to produce 'scouring.' Potatoes should always be fed boiled, and warm, but not hot enough to burn the mouth of the fowl. They should also be broken or mashed a little, for when one is thrown to them whole they seem to mistake it for a stone, and will often leave it untouched, while they will pounce eagerly upon it if the skin is broken so that they can see the white of the interior. Any kind of boiled vegetables are excellent food for fowls, but they are not fond of raw vegetables.

SHEEP TENDING.

A BARN-YARD.

See Note 5.

"Fowls eat readily grass, and many kinds of plants and leaves. They relish the leaves of lettuce, endive, spinach, and cabbage, but reject those of the strawberry, celery, parsnip, carrot, and potato. Fowls are fond of all sorts of the refuse of the table and kitchen, such as crumbs of bread, fragments of pastry, bits of spoiled fruit, and apple-parings.

"There is perhaps no species of insect which fowls will not eat. They are very fond of flies, beetles, grasshoppers, crickets, and every sort of worm, grub, and maggot. From this, and from the eagerness with which they pounce upon any scrap of meat which they can discover, it might be supposed that they are more carnivorous than graminivorous. But the fact is, that this arises from the fact that animal food is in general the exception in their regular diet, and is, therefore, a dainty. Feed a fowl mainly upon meat, and it will show the same voracity for grain. But advantage can be taken of this omnivorous propensity to save every scrap of meat, which would otherwise be wasted. It makes little difference whether the meat is raw or cooked, salt or fresh; and fish is equally acceptable to them as flesh. If there is any one thing of which a hen is more fond than another, it is bits of suet or fat; but if this is given to her in any considerable quantity, she will soon grow too fat to continue to lay eggs."

An incidental advantage in poultry-raising is, that the feeding of the fowls and the hunting up of the eggs can be performed by women just as well as by men; by children just as well as by adults. It is a work for which children have an instinctive fondness. Few boys or girls who are able to run about need much urgency to feed the chickens or hunt for the eggs. While, therefore, it is not probable that poultry-raising will be adopted by many persons as an exclusive occupation, it can be made a very remunerative adjunct to the ordinary work of almost every farmer. The high prices at which eggs are sold is proof that the supply for sale is now less than the demand; and there is no reason why the supply cannot be made equal to any possible demand; and, moreover, eggs are imperishable to such an extent that the producer is not forced to sell his eggs at any particular day in order that they may not spoil on his hands.

Bees.—The honey-bee, as a partially domesticated creature, finds its place among live-stock. The keeping of bees was formerly a considerable branch of industry. The Census of 1850 reported the production of 14,853,790 pounds of beeswax and honey in that year. In 1860 there were 1,322,787 pounds of wax and 23,366,357 pounds of honey—an increase of 68 per cent. Great exertions were put forth to extend the business of bee-keeping. Bees reported to be much more productive than the native species were imported from Italy, and improved hives were invented. One apiarian reported a profit in a single year of $1800 from 130 hives; another had cleared $35 in one year from a single colony; and it was affirmed that from every acre favorably situated in the United States a pound of honey might be produced, if the bees could only be had. But, notwithstanding all this, the business declined, and in 1870 the product was 14,702,815 pounds of honey and 681,129 pounds of wax—a decrease in 1870 of 40 per cent. The Census Report of 1880 makes no separate mention of these products, although 1016 "apiarists" are reported, of whom only 17 were females.

That honey in almost any quantity can be produced is unquestionable; and a pound of honey will readily sell for two or three times as much as a pound of sugar. Quite recently it has been suggested that "bee-raising particularly commends itself to ladies, because there is so little labor involved in it; it is like having a colony of small slaves at work while the owner is occupied with other things."

CHAPTER XI.

PRODUCTS OF THE DAIRY.

MILK, butter, and cheese constitute the products of the dairy. Table X., on the following page, shows for each State the quantity of these produced in 1870 and 1880.

MILK.—It is estimated that an average cow, of our present breeds, will yield 450 gallons of milk per year. At this rate the twelve and a half millions of milch cows in the United States would yield more than five thousand six hundred millions (5,625,000,000) of gallons a year. Probably the actual production is considerably less than this, for very frequently the cows themselves are poor milkers and are in bad condition. The figures in the Census Report of 1880 enable us to account for the uses to which nearly 3,500,000,000 gallons were put.

The quantity of milk is given therein at a little more than 530,000,000 gallons. By this must be intended the milk sold as such, not including the large quantity used on the farms, nor the much larger quantity manufactured into butter and cheese. But, of this milk sold, about 100,000,000 gallons were sold to butter and cheese factories, the quantity sold and consumed as milk being about 430,000,000 gallons. The value of all the milk sold, at 10 cents per gallon, was $53,000,000. It is estimated that upon an average three gallons of milk are required to produce a pound of butter, and two gallons for a pound of cheese. Besides that made in the factories, there were about 780,000,000 pounds of butter and 27,000,000 pounds of cheese produced upon farms, which required 2,880,000,000 gallons of milk. Thus, we have 3,416,000,000 gallons of milk sold either as such or made into butter and cheese. There are

TABLE X.—DAIRY PRODUCTS.

States and Territories.	Milk.		Butter.		Cheese.	
	1870.	1880.	1870.	1880.	1870.	1880.
	Gallons.	*Gallons.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Alabama	104,657	267,380	3,213,753	7,997,719	2,732	14,091
Arizona	4,800	42,618	800	61,817	14,500	18,360
Arkansas	31,350	316,858	2,753,931	7,790,013	2,119	26,301
California	3,693,021	12,353,178	7,969,744	14,084,405	3,395,074	2,566,618
Colorado	19,520	506,706	392,920	860,379	33,626	10,867
Connecticut	6,253,259	12,289,893	6,716,007	8,198,995	2,031,194	826,195
Dakota	....	415,119	209,735	2,000,955	1,850	39,437
Delaware	758,603	1,132,434	1,171,963	1,876,275	315	1,712
Dist. of Columbia	126,077	496,789	4,495	20,290	....	....
Florida	3,002	40,967	100,989	353,156	25	2,406
Georgia	109,139	374,645	4,499,572	7,424,485	4,292	19,151
Idaho	11,250	15,627	111,480	310,644	4,464	20,295
Illinois	9,258,545	45,419,719	36,083,405	53,657,943	1,661,703	1,035,069
Indiana	936,983	6,723,840	22,915,385	37,377,797	283,807	367,561
Iowa	688,800	15,965,612	27,512,179	55,481,958	1,087,741	1,075,988
Kansas	196,662	1,360,235	5,022,758	21,671,762	226,607	483,987
Kentucky	1,345,779	2,513,209	11,874,978	18,211,904	115,219	58,468
Louisiana	833,928	256,241	322,405	916,089	11,747	7,618
Maine	1,374,091	3,720,783	11,636,482	14,103,966	1,152,590	1,167,730
Maryland	1,520,101	4,722,944	5,014,729	7,485,871	6,732	17,416
Massachusetts	15,284,057	29,662,953	6,559,161	9,655,587	2,245,873	829,528
Michigan	2,277,122	7,898,273	24,400,185	38,821,890	670,804	440,540
Minnesota	208,130	1,504,407	9,522,010	19,161,385	233,977	523,138
Mississippi	17,052	427,492	2,613,521	7,454,657	3,099	4,239
Missouri	857,704	3,173,017	14,455,825	28,572,124	204,090	283,484
Montana Ter.	105,186	41,165	408,080	403,738	25,603	55,570
Nebraska	95,059	625,783	1,539,535	9,725,198	46,142	230,819
Nevada	63,850	149,889	110,880	335,188	....	17,420
New Hampshire	2,352,884	5,739,128	5,965,080	7,247,272	849,118	807,076
New Jersey	5,373,323	15,472,783	8,266,023	9,513,835	38,229	66,518
New Mexico Ter.	813	10,036	12,912	44,827	27,239	10,501
New York	135,775,919	231,965,533	107,147,526	111,922,423	22,769,964	8,362,590
North Carolina	17,145	446,798	4,297,834	7,212,507	75,185	57,380
Ohio	22,275,344	46,801,537	50,266,372	67,634,263	8,169,486	2,170,245
Oregon	107,367	227,540	1,418,373	2,443,725	79,333	153,198
Pennsylvania	14,411,729	36,540,540	60,834,644	79,336,012	1,145,209	1,008,686
Rhode Island	1,944,044	3,831,706	941,199	1,007,103	81,976	67,171
South Carolina	241,815	257,186	1,461,980	3,196,851	169	16,018
Tennessee	415,786	1,006,795	9,571,069	17,886,369	142,240	98,740
Texas	62,771	1,296,806	3,712,747	13,899,320	34,342	58,466
Utah Territory	11,240	155,263	310,335	1,052,903	69,603	126,727
Vermont	3,835,840	6,526,550	17,844,396	25,240,826	4,830,700	1,545,789
Virginia	266,812	1,224,469	6,979,269	11,470,923	71,743	85,535
Washington Ter.	21,060	226,703	407,306	1,356,103	17,465	109,200
West Virginia	144,895	750,279	5,044,475	9,309,517	32,429	100,300
Wisconsin	2,059,105	25,156,977	22,473,036	33,353,045	1,591,798	2,281,411
Wyoming Ter.	4,980	75,343	1,200	105,643	....	2,930
Total	235,500,599	530,129,748	514,092,683	777,249,657	53,492,153	27,272,489

no means of ascertaining even approximately the quantity which is consumed upon farms as food for calves and the like; but at the very lowest estimate it must amount to several hundred millions of gallons. Assuming 450 gallons of milk per year to be the yield of an average milch cow, this is far less than the quantity which is given by cows of better breeds. In *Harper's Magazine* for January, 1883, Mr. Conrad Wilson gives some very important statistics upon this point, which show the possibilities of what may be attained under the most favorable conditions.

Of nine cows in the State of New York, all of them of the Holstein breed, the highest product of any one in a year was 2250 gallons, the lowest of any of them was 1770 gallons; the average of the whole nine being 2000 gallons. Of five cows of Short-horn, Devon, Ayrshire, and Jersey breeds the average was 1450 gallons; the highest being 1510 gallons by a Short-horn, the lowest, 1190 gallons, by a Jersey. As far as quantity of milk is concerned, the Holstein breed holds the first place. But in regard to the production of butter—more important than the mere quantity of milk—the pre-eminence belongs to the Jersey breed. The highest record for butter for a Short-horn is 513 pounds in a year; for a Holstein, 509; for a Devon, 480; for an Ayrshire, 380; the average being 473 pounds. Of ten selected Jerseys the average was 596 pounds; the highest for any of them being 778, the lowest 500 pounds.

The quantity of milk required for a pound of butter varies greatly. Mr. Wilson finds three cases in which four quarts of milk gave a pound of butter, and three more in which a pound was produced from less than five quarts. A pound of butter from between five and six quarts, inclusive, is recorded in about twenty-five instances; a pound from eight and a half quarts or less is reported in a still greater number of instances, including the averages of several selected herds. In all these instances the trial was, of course, made under the most favorable conditions. Not only were the best breeds chosen, but the best individuals of each breed; and they received the strictest care and the most abundant feeding. And, moreover, the manufacture of the butter was conducted in the most skilful manner, so that the utmost possible quantity should be produced. But when we compare the 1500 or 2000 gallons of milk and the 500, 600, and 700 and more pounds of butter a year from a single cow, which have been attained, with the 450 gallons of milk and 30 or 40 pounds of butter, the average product of our native cows, the profit which may be realized from improved breeding is apparent. But improvement in the breed is by no means the only thing to be attended to in enhancing the products of the dairy. Mr. Wilson well says:

"It is evident that pedigree is a very essential element in the value of cows. Whenever a young cow marks the beginning of her career with an unusual flow of milk or yield of butter after her first calf, it is not only a proof of the generous bounty of Nature, but reveals, also, a new possibility of production that is always valuable to the owner. But it is also true, and no less important to know, that grade animals in a well-managed dairy can be made quite as productive as thorough-breds, and often more so. Yet this does not at all imply that the latter can be dispensed with; for we cannot have a good quality of grades without a good quality of blood to start with. Pedigree is one of the factors of a good cow, but it is not by any means the only one. Maximum results in the dairy are not the outcome of any single condition. They depend not merely on the capacity and breed of the cow, but also, and equally, on the intelligence and good management of the owner; and, what is equally true but seldom considered, even the capacity of the cow is itself, to a large extent, the product of human skill."

But, leaving out of view these exceptional cases, there is no lack of inducements in the same direction drawn from the common line of well-conducted dairying. It is easy to see that the larger the number of factors included in a given trial in any line in husbandry, the more instructive and valuable such trial will be. For example, says Mr. Wilson:

"The Hon. Zadok Pratt, of Greene County, New York, with his trial of fifty-nine cows, continued through nine years, showed that with a yearly milk product of less than 2500 quarts per cow, the average yield of butter was 200 pounds, worth (including the skimmed milk) $80; and, further, that the cost of the butter was less than 8 cents per pound; while the net yearly profit of the herd was in reality over $3000. Again, it appears from a trial of twenty-three cows, by the Hon. G. W. Boutwell, of Massachusetts, that the cost of the butter was still less than in the trial by Mr. Pratt, while the yearly rate of profit for the herd showed a wider margin."

The recorded results, amply vouched for, of numerous successful trials made by other practical men, whose experience includes and represents several thousand cows, amply confirms those which have been cited. In view of them all Mr. Wilson says:

> "Experience has already proved the possibility of keeping two cows on an acre under full feed throughout the year. If, according to the yield of milk per cow, as given above, it shall be made to appear that milk can be produced at the yearly rate of even 2500 or 3000 quarts per cow, and at a cost of one cent a quart, and butter at the rate of 200 to 300 pounds per cow, at a cost of six or seven cents per pound; and, further, that these results are fairly within the reach of the average dairyman, it will then be seen that some real progress has been made by our farmers towards solving the food question of the future."

The production of milk being the immediate object of the dairy-farmer, the farmer must so feed and otherwise manage his cows that they shall be in a condition to yield the greatest amount of milk of which they are capable. Mrs. Gibbons tells us that in the great milk-producing region of England "the cows never come out of the stable except when the weather is dry, when they are turned into the yard or into rough pasture. In the summer they are fed with green vetches (a kind of coarse pea), among which enough oats had been sowed to hold up these climbing plants. Besides this green fodder, each cow receives daily about a bushel of brewer's grains or malted barley. Mangel-wurzel is fed to the cows in winter, each animal getting daily one bushel of sliced mangel, one bushel of the grains, and as much oat-straw as she wants. The cows average two and a half gallons of milk per day. But the Durhams, which are considered the best milkers, not less than six gallons a day."

The extent to which milch cows with us should be pastured or kept under cover will depend upon various conditions. But in most parts of the country they must be housed for a part of the year; and it is indispensable that the stable be properly constructed. A cow, in order to maintain health, needs pure air as certainly as does a man. When housed she lives in an artificial condition, and provision must accordingly be made against the danger arising from this source. She must be protected from sudden and great changes of temperature. A healthy person, living habitually in the open air, may with impunity encounter fluctuations in temperature which would be dangerous to an equally healthy person living habitually within doors. It is precisely so with a cow or any other domesticated animal.

As to food for cows, our range is much wider than that of the English milk-producer. With him, indeed, "brewer's grains" are more attainable than with us; but the use of these, except in very moderate proportions, as compared with other food, is strongly questioned. We can raise the turnips and other roots quite as well as he can, if it shall be found to be profitable. As to the various sorts of green fodder and "stover," we have at hand an immense supply in our regular corn-crop. Of this Mr. Wilson, from whom we have so freely quoted, says:

"In a recent letter to the Commissioner of Agriculture on the subject of 'ensilage,' which was published in the *American Dairyman*, I submitted some important facts relating to the corn-crop, which have an important bearing on the question of feeding, and on the products of the dairy. It was therein shown that the total annual yield of 'corn stover,' in its various forms, is not less than 120,000,000 tons. Strangely as this stalk-crop has been ignored by the Census Bureau, it has none the less influenced, and for many years largely increased, the sum-total of milk, butter, and cheese supplied by our farmers to the markets of the world."

The sorghum-plant promises, also, to form a further addition to our stock of "stover;" and if ensilage shall be proven to possess, in any good degree, the advantages claimed for it by its advocates, the grass-crop, instead of being converted into hay, will be chiefly used as green fodder.

But, whatever else may be yet more or less in question as to the feeding of milch cows, it is settled beyond all question that the "swill slops" of distilleries are wholly unfit for that purpose; and by the laws of the State of New York the milk of cows fed on this swill is declared to be unwholesome, and its sale is forbidden. Whether it may be used in very small proportions, and in connection with other food, is, perhaps, a question not yet fully settled. Mr. C. L. Flint, Secretary of the Massachusetts Board of Agriculture, says:

VIEW OF ECHO FARM BUILDINGS FROM PASTURES.

JERSEYS.

See Note 6.

"Properly fed, in limited quantities, in combination with more bulky food, still-swill or slops *may* be a valuable article for the dairyman. But if given without the addition of other kinds of food it soon affects the health of the animals fed on it; and no pure and healthy milk can be produced by a diseased animal. The milk of cows fed upon swill-milk contains a subtle poison, which is as difficult to detect by any known process as the miasma of an atmosphere tainted by yellow-fever or cholera. Its effect upon the system of young children is very destructive, causing diseases of various kinds, and, if continued, certain death."

The effects of swill-milk upon adults would undoubtedly be equally deleterious, if their food, like that of infants, consisted mainly of milk. Moreover, the flesh of a cow fed mainly upon distiller's swill is utterly unfit for food. It is really half-putrid before the animal is killed. The only safe and wise course is for the farmer or dairyman to refrain entirely from feeding his milch cows upon distiller's slops, at least until far wider knowledge than has yet been attained has shown that it may be properly used within certain limits, and what those limits are.

That milk, directly and as such, should enter more largely than it does into our food is beginning to be more and more acknowledged. But there are many circumstances in which it is not easy to obtain it, as on shipboard. To meet this want milk is boiled in a vacuum-pan, at a temperature of some 60° below the boiling-point of water, until four or five quarts are reduced to one, and a proportion of refined cane-sugar is added. This "preserved" milk, hermetically sealed in cans, will keep for years. For immediate use milk is also condensed by boiling, without the addition of sugar. It will keep for several days, and is by many preferred to fresh milk. In cities it is probably safer to rely upon this condensed milk, when prepared by a reputable establishment, than to trust to the chances of an irresponsible milkman. Condensed milk, when properly prepared, retains its original flavor; and its preparation has become a growing and lucrative industry—confined, however, to large companies. But the chief purpose for which milk is used is for the manufacture of butter and cheese.

Cheese.—The production of cheese has undergone marked fluctuations within the last thirty years, and there has been an almost entire change in the mode of its manufacture. In 1850 the entire production in the United States was 105,535,803 pounds; in 1860 it was 103,663,927 pounds, being a slight decrease. Up to this time cheese had been made wholly upon farms, but now factories were established for its manufacture, by which now far the greater part is produced. In 1870 the quantity was 162,927,382 pounds, being an increase over 1860 of 57 per cent. Of this cheese about one-third was made in factories, and two-thirds on farms. In 1880 the production was 199,022,984 pounds, being an increase over 1870 of 22 per cent. Of this cheese nearly seven-eighths was made in factories. The value of the cheese product of 1880, at eight cents per pound, was about $16,000,000.

Of the 171,750,495 pounds of factory cheese about 63 per cent. was made in the State of New York, where there were 1652 butter and cheese factories; about 14 per cent. in Ohio and Wisconsin, where there were 864 factories; and the remainder in twenty-six States. Of the 27,272,489 pounds of cheese produced upon farms about 30 per cent. was made in New York; 25 per cent. in California, Ohio, and Wisconsin; and the remainder in each of the other States. The production of cheese has, however, hardly been attempted in any of the States south of the Potomac, in all of which scarcely 500,000 pounds were made in 1880. The relative decline between 1870 and 1880 in the production of cheese is greatest in the States where the largest quantities are made. Thus, in New York the increase was only 8 per cent. This indicates that cheese-making in these States, even when the manufacture is systematized in factories, is relatively unremunerative; or, rather, that the milk can be more profitably used either by selling it as such, or by making it into butter. But there is no apparent reason why cheese-making might not be profitably carried on by farmers in certain sections of the South where the climate is especially adapted to cattle-raising, and where there is no market for milk. Virginia, West Virginia, Kentucky, Tennessee, and Georgia would seem to be well adapted for cheese-making.

Butter.—Butter is by far the most important of our dairy products, and the ratio of the increase of its production has for the last thirty years exceeded that of the increase of population at each decennial period, with the exception of 1860–1870. In 1850 there were produced 313,345,306 pounds of butter; in 1860 there were 459,681,372 pounds; increase, 46 per cent., that of the population being 38 per cent. In 1870 the product of butter was 514,092,683 pounds; increase, 12 per cent., that of the population being 25 per cent. The civil war diverted much of the industry of the country away from agricultural pursuits. In 1880 the production of butter was 793,721,450 pounds; increase, 55 per cent., that of the population being 30 per cent. Or, taking the whole period, 1850–1880, together, the production of butter has increased from 313,345,893 pounds to 793,721,450 pounds, or 153 per cent.; while during this period the population has increased from 19,553,068 to 50,155,783, or 156 per cent. That is, taking the whole thirty years, the ratio of increase in the production of butter has been almost the same as that of the increase of population; while for the last ten years it has been nearly double, showing that the business of butter-making has been a lucrative one as compared with other branches of industry.

Within a few years a change has been introduced in the manufacture of butter similar to that made in the manufacture of cheese. In several sections butter-factories have been established, to which the farmers sell their milk, instead of making it into butter themselves. In 1880 only about 2 per cent. of the whole product was factory butter, but the proportion has increased very considerably since. The factory butter commanded about 24 cents per pound—considerably more than the general average of even good grades. About one quarter of all the factory butter was produced in the State of New York.

As is shown in Table X., about 15 per cent. of all the butter of the United States is made in New York, which produced (including factory butter) 115,119,847 pounds. About 33 per cent. was made in Pennsylvania, Ohio, Iowa, and Illinois, each of which produced more than 50,000,000 pounds. About 20 per cent. was made in Michigan, Indiana, Wisconsin, and Vermont, each of which produced more than 25,000,000 pounds. Butter is made in considerable quantities in most of the other States, but less than elsewhere in the Southern States, none of which, except Tennessee, Texas, and Virginia, produced as much as 10,000,000 pounds.

The total value of the butter produced in the United States in 1880, at 20 cents per pound, was $158,744,290. This was the general average of the whole product; but a very considerable proportion brought much less than this, while a few of the very choicest grades commanded a dollar a pound, and from that all the way down to 25 cents. There is no valid reason why any poor butter should be brought to market. The milk of some breeds of cows produces butter of much finer flavor than that of others, and very much depends also upon the kind of food; but good butter can be made from the milk of any healthy cow which is fed upon suitable food, and is otherwise properly cared for. Bad butter is the invariable result of bad management, either in the manufacture or in the subsequent putting up for market—most likely of both. It costs very little more labor—although it requires much more care and skill—to produce a pound of good butter than a pound of bad; and the expense of feeding a good milker is no greater than that of feeding a poor one.

The dairy business, in its various phases, is one of the most profitable and one of the least hazardous of the departments of husbandry. The particular form to be chosen depends greatly upon the locality. If one's location is near a city or large town or manufacturing village, the most profitable mode of disposing of the milk will probably be to sell it as such directly to the consumers. If too far from such a market, making it into butter is the best course. There is little reason to apprehend that the home market for dairy products will be over-supplied; for the rapid increase of the population of our principal cities increases the demand in them, and every new town forms of itself a new market for the dairy products of its vicinity, especially for the milk, which must be produced near by. But, whatever the particular line selected, three things demand the special attention of every dairyman: 1. Select the breeds of cows best adapted to your special purpose. If you propose to sell your milk, have the most copious milkers; if you propose to make butter, choose the breed whose milk has been proved to be the richest; for, although the absolute quantity may be considerably less, it contains a larger proportion of what you want. 2. Having got your cows, take proper care of them, in the matter of food and housing. 3. If you propose to make butter, learn how to make the best, and how to put it up for preservation after it has been made.

The reader will please note that in Table X. the figures give only the quantity of butter and cheese made upon farms. But, as noted upon page 140, much of the butter and most of the cheese produced in 1880 was made in factories, and not upon farms. This quantity has been taken into account when estimating the progress in these branches of farming industry.

CHAPTER XII.

REQUISITES FOR THE SUCCESSFUL FARMER.

IN the summer of 1880 there were in the United States 4,008,907 "farms" of land more or less "improved." There were 4,346,515 "farmers," properly so-called (including gardeners, stock-raisers, etc.), besides 3,323,876 "agricultural laborers;" so that of the 17,392,099 persons pursuing regular occupations, 7,670,493,* or 44 per cent., were directly engaged in agricultural labor. There being 9 per cent. more farmers than farms, a small number of farms were tilled by more than one farmer; but nearly every farmer must be the owner of the soil which he cultivates, with or without the services of hired laborers.

Farmers themselves, as distinguished from agricultural laborers, constitute hardly 25 per cent. of those engaged in gainful pursuits; but a very much larger proportion of the wealth of the country is in their possession. The assessed value of all the real estate in the country, in 1880, was $13,036,766,925; that of farms was $10,197,096,776, or 77 per cent. of the whole. This belonged to farmers, leaving only 23 per cent. to all other classes. The personal property was assessed at $3,866,226,618. Of this at least—live-stock, $1,500,464,609, and farm implements and machinery, $406,520,055—$1,906,984,655, or 49.3 per cent., was owned by agriculturists. Thus, out of a total assessed value of $16,902,993,543 of real and personal property $12,104,081,431, or 71 per cent., belonged to the farmers. There are no means

* So reported in the Census, but the actual number was considerably larger; for it is added: "In agricultural districts many enumerators have reported 'agricultural laborers' simply as 'laborers.'"

of ascertaining what proportion of the $4,798,912,112 of assessed property, real and personal, which constitute the remainder of the realized wealth of the nation, is in their hands; but it is undoubtedly comparatively small. *But this is certain: not less than* 71 *per cent. of all the wealth of the people of the United States belongs to the farmers, who form only* 23 *per cent. of the entire active population, as reported in the Census.*

In considering the special qualifications required for a successful farmer, we must, in the first place, have regard to the kind of material upon which his energies are to be employed. The mechanic has, for the most part, to do with mere inorganic or dead matter, which he can work up into such shape and form as he pleases, under the limitations prescribed by the nature of that material. He cannot, indeed, melt a beam of wood and cast it into a wheel, or hammer a block of granite into sheets, as though it were iron, or draw a mass of clay into wire, as though it were gold. But he can fashion the wood or stone, the clay or metal, the cotton or the wool, into any form which they are by nature capable of assuming.

The farmer, on the other hand, has to deal with substances which have life in themselves, vegetable or animal. The seed which he sows is not mere dead matter, but has life in itself, and, under proper conditions, will reproduce and multiply itself. It is his business to find out what these conditions are, to aid them when they are present, and to supply them when they are partially deficient. He must, in a word, learn what are the laws of Nature in respect to the growth of the grain or vegetables which he undertakes to cultivate. In so far as he acts in accordance with these laws will he be successful; in just so far as he violates or fails to follow these laws will he be unsuccessful. The first of these laws is, that all plants derive their support from the air and the earth. With that portion which is derived from the atmosphere he has little to do; Nature does that for him. With that part which is drawn from the soil he has everything to do. If he will see to it that the plant has what its roots need, the plant itself will to a great extent look out for what it needs from air and sunshine.

Agricultural Chemistry.—At the very foundation of all successful farming lies a practical knowledge of what is called "Agricultural Chemistry." This involves the study of the nature and action of those substances of which the products of the farm are ultimately composed. The growing plant contains a large proportion of water, varying by weight from 40 to 90 per cent.; and this in the proportions required by each sort is absolutely indispensable as the vehicle by which all the nutriment absorbed is conveyed from the roots or leaves to the other parts of the plant. Of the 10 to 60 per cent. of other matter which forms the dry substance of the plant, nearly one-half consists of carbon. This is so abundantly and universally supplied from the carbonic acid, contained in the atmosphere, that there is no need for the farmer to provide it in any shape.

There may be an abundance of water present in the soil, and yet it will be unfertile if it lacks certain other elements. Any soil will be absolutely unfertile unless it contains more or less of each of the following substances: phosphoric acid, sulphuric acid, potash, lime, magnesia, and oxide of iron; and these must not only be present, but they must be in a form in which the plant can take up. Every plant requires all of these constituents; some of them more and some less of each kind. The plant takes them up from the soil; and if it died where it grew, and no part of it was carried away, the soil would retain, and even increase, its fertility for an unlimited period. But in agricultural crops a portion of the plant is taken away, and with it some of these essential elements; and the equivalent of these must be restored to the soil, or it will become "worn out."

The percentage of all these elements in a fertile soil is very small. Careful experiments indicate that a field in which not more than 250 pounds of these "ash elements" are present in 1,000,000 pounds of the soil—that is, one part in 4000—may be capable of producing 33 bushels of wheat to the acre. The crop will exhaust 140 pounds of this, which must be renewed. Practically, however, the proportion of nutritive matter is much larger than this, but rarely more than one part in 400. Manures and other fertilizers operate mainly by supplying one or more of these elements abstracted by the crop from the soil. The successful farmer must, therefore, learn not only what kinds of crops are best adapted for his soil, but also what kinds of fertilizers are needed to restore to it the elements which the crop has taken away.

Rotation of Crops.—Theoretically it is possible, by proper manuring, to produce an abundant crop of any kind for an indefinite time upon the same field. The annual inundation of the Nile does this for Egypt; and in China and Japan it is said to be done by human means. But with us the end aimed at is best attained by a rotation of crops. This rests upon the fact that some crops not only require different nutritive elements from others, but also draw them from a greater depth. Moreover, some crops—clover, for example—actually fertilize the soil in an indirect but actual manner; but there is a limit to the period in which this salutary effect is produced.

Market-Gardening, etc.—If the farmer's avocation takes the form of market-gardening or fruit-raising, he needs a still more thorough knowledge of agricultural chemistry, and of many other matters. The variety of his products is greatly increased, and each crop has peculiarities of its own. Then the cultivation of the soil is far more thorough than is required for ordinary field-crops. In fact, it requires more thorough study to cultivate properly a market farm or garden of five acres than to manage tolerably well a grain-farm or cotton-field of five hundred acres; but in a favorable locality and with due skill the five acres may be made to yield a greater net profit than the five hundred usually does.

The products of the garden and orchard are also more delicate and perishable than those of the field, and therefore require more care and skill in gathering and preserving them. More business skill is, moreover, demanded in selling the crop. For wheat and corn, for cotton and hay, there are established markets, where any quantity can be sold at any time, and the fluctuations in price from week to week are within very narrow limits; so that the producer may be pretty certain in any given month as to the price which his crop will bring. The gardener has far less certainty in this respect, and he must study his market much more closely, so that he may not bring his perishable wares to a market over-supplied at the moment. The gardener and orchardist, in addition to agricultural knowledge and skill, has ample scope for the exercise of the capacities of a trader, who needs to keep an intelligent lookout for markets and customers, and not unfrequently to create both.

Stock-Raising.—If the farmer is—as most farmers are—not merely a grower of crops, but a raiser of live-stock, the circle of knowledge required for success, and the sphere for profitable enterprise, become greatly enlarged. He has to deal not only with vegetable but with animal life, and to make both of them work together for his advantage. He must study, not only agricultural chemistry and vegetable physiology, but animal physiology also. He must find out, not only what kind of stock may be profitable in itself, but what kind he can make profitable just where he is. He will not, for example, embark in wool-growing where land is worth a hundred dollars an acre, for it will cost him much more to produce a pound of wool than it will in Texas or Colorado, where land costs comparatively little; and a pound of wool produced in New York will bring no more than one produced in Texas. In such respects he will find the statistics collated from the successive Census Reports to be of the highest value, for they embody the results of the experience of many thousands of individuals, continued for a series of years. If in any section some branch of industry is found to have increased rapidly, or even steadily, as compared with the increase of the population, it may be assumed that it has proved relatively profitable in that section. It may be, indeed, that the success of any particular industry in a given section has been prevented by conditions which no longer exist there. Thus, the growth of sorghum was checked because there was no known means of cheaply crystallizing the juice into sugar. But if it shall prove that this obstacle no longer exists, it may be safely assumed that the culture of sorghum will hereafter be a profitable one.

A HOME LAWN.

See Note 7.

And, moreover, it is not to be assumed, because any branch of industry has not as yet been introduced into a particular region that it cannot be made profitable there. Florida has abounded in wild orange-trees for two centuries; but it is not until within half a score of years that orange culture has been fairly begun there; and yet it is now one of the most lucrative branches of planting enterprise. So, too, with the orange and the grape in California, which have already been treated in the chapter on "The Products of the Orchard." All these considerations pertain to every department of industry as well as to stock-raising.

The stock-raiser needs not only wisely to choose his stock, but he must learn how to take care of it. He must learn what kinds of food are best in themselves, and which of these he can provide in sufficient quantities and most economically. He must also make himself acquainted with the habits of animals, especially as modified by domestication. He must learn to what diseases each species is especially liable; how these diseases are occasioned; by what means they may be prevented; and how they should be treated when they do occur. Stock-raising is in very many cases not merely an important department of general farming, but the main pursuit of the raiser, the production of crops being altogether subsidiary. In sections where the conditions are favorable—say in Texas and Colorado at present, and in Dakota in the near future—this is, and is likely long to be, a very profitable business; and it is now attracting to this country a very large amount of capital and enterprise. It cannot, of course, be conducted without some capital; but, if a person have the requisite personal qualifications, it may be safely commenced and profitably conducted, with a moderate capital to start with.

Stock-Breeding.—A special branch of the industry of stock-raising is the breeding of the various species of live-stock, not for the direct use of their products, as butter, cheese, and wool, or of their flesh as food, but for the sake of producing and perpetuating improved breeds, which can be sold for prices far exceeding those of ordinary animals. This industry extends to some extent to all live-stock, but chiefly to neat-cattle and horses. The reports of the regular yearly sales of the increase of the great breeding-farms evinces the profits which accrue from this business when judiciously carried on. In horse-breeding the pecuniary results are the most striking. One very recent instance clearly shows the profits which must have actually been realized.

On May 19, 1883, was held the annual auction sale of the previous year's increase of the Elmendorf stud-farm, near Lexington, Kentucky. There were sold 23 yearling colts, the prices obtained for each being as follows: $5100, $3700, $3000, $2500, $2450, $2000 (two), $1850, $1800, $1550, $1150, $1100, $1000, $900, $850, $550, $450, $420, $350, $270, $240, $220, $150; the average being $1460.87 per head. There were sold 20 yearling fillies, at the following prices: $2500, $2200, $1150, $875, $820, $725, $580, $575, $570, $500 (two), $425, $420, $325, $310, $230 (two), $195, $190; the average being $676.50. Thus, 43 yearling colts and fillies, the product of one breeding-farm, sold in one day, brought $47,130, an average of $1095.80 per head. This, of course, must be looked upon as an extremely favorable case. The capital invested in the thoroughbred sires and dams was great, and the running expenses large; but when it is borne in mind that the average value of a horse throughout the country is less than $60, and that these yearling colts averaged almost $1100 per head, it is clear that the actual profit of this breeding-farm must have been very great. But in one important respect this case is not exceptional: the demand for blooded horses is constant, and the prices realized for them were never higher; and there is no probability that the business of rearing them will be less profitable than it now is.

General Requisites.—The successful farmer, more than almost any other man, must be able to turn his hands to many things. He will often have to put up his house and barn and fences, and always to maintain them in repair; to keep his tools and implements in order. He must do for himself a thousand things which the resident of a town or city will have done for him by others. The more mechanical skill the farmer has, the greater—other things being equal—will be his probabilities of success.

Farming and Capital.—As has already been shown, a very considerable part of the wealth of the country is in the hands of farmers. Making every possible allowance for discrepancies in the modes of valuation, the proportion in their hands cannot be less than two-thirds of the whole wealth of the country. Taking into view only farms and buildings, live-stock on farms, and agricultural implements, the value of these, if equally divided among the about four and a quarter millions of farmers and planters, would give to each of them about $2800. It is not, of course, absolutely necessary that every one who begins life as a farmer should have that much. If he has pluck and intelligence, industry and economy, he may safely adventure in a new region with much less. But, even if he obtains his land by preemption under the homestead laws, or buys it—as he may—upon a long credit and on easy terms, of the Government or of railway corporations, he must have some ready money with which to put up a hut, buy a team, implements, and seed, and food for the months that must pass before the first crop can be harvested. The man who is to make money as a farmer must have some money with which to begin to make it. If he has not a few hundred dollars to start with, he cannot start at all. If he has reached the age of eight-and-twenty, and has not been industrious and economical enough to lay so much by, he may make up his mind pretty certainly that, whatever else he may be fit for, he is not the man who can take up farming with any reasonable hope of even moderate pecuniary success.

For a young man who has only his hands and head to depend upon, and who yet intends to become a farmer, the best thing—and, indeed, in most cases, the only thing—is to hire himself out to work upon a farm. He must deliberately make up his mind that he will not unnecessarily spend a dollar of his earnings. Such a man will find it easy to get work and fair wages. If he does this in the general region where he has it in mind to raise himself from a farm-hand to a farmer, so much the better. He will learn his business better there than he can do it elsewhere. If, for example, he proposes to become an orange-grower or grape-raiser, a year in California is worth more to him than three years upon the grain-fields of Illinois or Kansas; and the special practical knowledge which one acquires as an orchardist in California would stand him in little stead as a stock-raiser in Colorado. No sort of knowledge is absolutely useless anywhere; but one who is to live in Louisiana cannot profitably spend much time in learning the best methods of house-warming, although such knowledge would be very useful to him if his home were to be in Maine.

The Emigrant Farmer.—If the farmer, or the person who means to be a farmer, has it in mind to emigrate, he needs to give to the matter of choosing his new home a more careful consideration than is required for any other person. The laborer, the mechanic, the manufacturing operative, or the professional man moves from place to place with few *impedimenta.* They can with little inconvenience change from one place to another. When one railroad is completed, the laborer who has been employed upon it can betake himself to another, without the necessity of leaving anything behind him or taking anything with him. If Chicago is burned down, masons and carpenters from New York and St. Louis can be there to rebuild it before the smoke has ceased to rise from the ruins. If the lawyer or the physician finds his profession overcrowded in Boston or Philadelphia, he can set off at short notice for any other town where there seems to be an opening for him. If a new mining region is discovered in the remotest corner of Nevada or Utah, engineers and assayists can hie thither as fast as the modes of conveyance will permit. None of these are of necessity bound by pecuniary ties to the place which they leave or to that to which they go.

Quite otherwise is it with the farmer. From the moment he owns a farm he is *adscriptus glebæ*—one bound to the soil, hardly less so because the bond is of his own making. He has struck his roots into the earth of his home. The soil is one of the tools with which he works, and he cannot, like the mechanic, carry his tools with him. The farmer who has once fixed himself should look well to the matter on all sides before deciding upon making a change at all; and if he has decided upon doing so, then he should examine, by all the lights available, the advantages and disadvantages which other localities promise, not merely for emigrants in general, but for himself in particular. And he must make up his mind beforehand that, wherever he goes, he will surely find some disadvantages for which he was not prepared.

The general object of the emigrant is to better his condition in one important respect or another. It may be that health, of himself or his family, is the immediate consideration. Some regions are so unhealthy that no wise person, except under the urgency of the strongest inducements, will ever think of making a home there. These pestilential districts are few in number and limited in extent in the United States. But there is a very considerable difference in the degree of healthfulness between sections none of which can be properly designated as insalubrious. Moreover, a climate perfectly salubrious for a person of one constitution is often dangerous to one of another constitution or habit of body. If a person is constitutionally predisposed to any particular type of disease, he should avoid the sections in which that type is prevalent. The Census Report for 1880 affords data for the solution of this problem better than have been hitherto accessible. This topic is considered in a subsequent chapter.

The farmer, in choosing the location of his home, is also choosing one for his children, perhaps for his children's children. For their future good it may be his duty to remove to a new country, and, for a time at least, to forego for himself many of the comforts and conveniences within his reach where he is. But, important as the mere question of dollars and cents is admitted to be, it is not the only thing to be taken into the account. Few men, accustomed to the amenities of civilized society and the advantages of education, can live happily in a region where barbarism and ignorance form the rule. In such case he must either shut himself up from society, or must associate with those whose companionship is worse, perhaps, than none at all. The statistics as to education and the like, in the chapter devoted to those topics, are eminently worthy of consideration.

But, supposing all these points settled, then comes the final consideration of making or earning money. "Where can *I*, with such qualifications as I possess, and with such means as I can command, most profitably take up my residence?" To begin with: a region comparatively sterile is not the one to which a farmer should go. Perhaps he may be located in such a region, and the certain disadvantages of removal may, in his case, outweigh the probable advantages of removal. If so, let him remain where he is, and try to improve his condition there. His New England fields may be naturally unfertile, compared with those of Kansas or California; but, by judicious culture bestowed upon the crops best suited to his soil and climate, not a little of this difference will practically disappear. His acre will yield only half as much wheat as an acre in Iowa; but upon it he can, perhaps, raise fruits or vegetables, the sale of which will enable him to buy the wheat grown upon two acres of the most fertile prairie land. In such case he can make more money by staying than by going.

But the possible, or even certain, crop which can be raised, although of the highest importance, is not the only important thing. The farmer and his family require many things which he cannot raise upon his own acres. He must either buy these things or go without them; and he cannot buy unless he have something which he can sell. No matter how many oranges or grapes his orchard or vineyard may produce, all of them, except the few which he and his family can consume, are practically worthless to him unless he have a market for them. It is not enough that there be a market somewhere, but there must be one which he can reach. The forecasting farmer will consider the question of the transportation of his crops no less than the raising of them. He will ask, "Is there, or will there soon be, a railroad or easy water-communication between me and the market?" If there is none now or certain to be in the near future, the fact will be a weighty objection. Our systems of natural and artificial intercommunication so interlace and overlap that there is no fertile section of any considerable extent which will not in time come to be penetrated by railways; and a person who can afford to wait long enough for results, or who wishes to lay the foundation of a fortune for his heirs, cannot, perhaps, in the end make more money than by purchasing large tracts of land now cheap, but which in time, when open to easy communication, will be greatly enhanced in value. But for the far greater number whose views do not reach so far ahead — those who wish to eat the fruit of the tree which they have planted — a location now within easy reach of market, or soon to be so, is every way the most profitable.

The emigrant from an older to a new country must make up his mind to make considerable changes in his mode of life. These changes need not now be as marked as they formerly were when emigrants mostly went out singly or in very small companies. The "colony system" has probably been more fairly tested in California than elsewhere. Usually a colony is a land speculation of a somewhat enlightened kind. A landholder lays out a tract of land in twenty-acre lots, marks out streets and roads, and offers the land for sale to whoever will buy, with a water-right annexed by deed to every twenty acres. He appoints a resident manager to advise the new settlers as to planting and culture, etc., but the main object is to sell the land. "Even under this crude system," says Nordhoff, "prosperous and happy homes have grown up with surprising rapidity." But he adds:

"The best and pleasantest way would be for four, six, or eight families to unite together, with the design to live on adjoining farms. Such an association could send out one of their number as a pioneer to seek a suitable location. For four families a 'section' (that is, a square mile, or 640 acres) of land would be sufficient. It would give to each 160 acres of land. But if more is required, and if, for instance, it was desired to settle upon the Government or railroad land in the Sacramento or San Joaquin Valley, these lands are held in alternate sections; and so complete is the railroad land-office in San Francisco, that a stranger would do best to go to that office, look over its maps and descriptions of railroad sections—which can be purchased on five years' credit, with one-fifth part paid down—and there, surveying the whole field at once, make up his mind what parts of it are worth a more particular examination. Having thus determined generally upon the part of the State which he thinks it best to examine, he will find it easy to make choice of some particular section or sections."

There are very evident advantages in organizing into companies much larger than of four families. If, instead of four, there were eight purchasing two or four sections, they would at the very outset form a community large enough to do, at a small cost to each, many things which would be very desirable to have done in the very beginning. A common system of draining and irrigation might be established, a school-house and church built at some central spot, so that no dwelling need be more than half a mile from it. Still better if a central half-section were divided into building-lots, each large enough for house and garden plot. Most likely every farmer would prefer to build his house there, instead of upon his own farm, the remotest corner of his 160 acres not being more than a mile away. Such a settlement would be a colony in the ancient sense of the word—an organized community transplanted into a new spot; a society springing up without passing through the phase of semi-barbarism. The family is a number of individuals bound together by ties of blood and common feeling. Such a settlement would be a number of families—bound together by ties of interest, indeed, but also by the stronger bond of common feelings, aims, and pursuits.

The original 160 acres for each family is altogether too much for a permanency; but it leaves scope for the natural family increase. As sons grow up from boyhood to manhood a part of the old home farm will be set off to each. There is room for the sixteen families on four square miles to double or even to quadruple themselves in a half-score of years. It is pretty generally conceded that 160 acres to be cultivated by a single farmer is better than any greater number; that 80 acres is better than 160; and not a few hold that 40 is better than 80. "People," says Nordhoff, "are gradually getting convinced, by the experience of others, that 80 acres is, in good localities and with water, a little too much, and 40 acres quite enough, for a fair start in life." If a man whom nature and his own efforts have qualified to become a successful farmer could go to California with not less than $1500, he could hardly do better than heed the advice (cited by Nordhoff) of one who is himself a successful farmer:

> "He should buy 40 acres, for which, with access to water, he would pay from $20 to $40 per acre—paying a quarter down, and the rest after from five to seven years. He should have a team of horses, costing from $100 to $150; plough, harrow, etc., say $75; house, according to his ability, from $100 to $500. All the shelter needed for his stock he could build of poles and thatched, at a cost of $10. He should put 30 acres in wheat, which in an average year would yield him clear money, after all his expenses, $15 per acre, or $450; this because he needs cash in hand to pay for land and improvements. The ten remaining acres he should plant thus: half an acre in kitchen-garden, which will supply his family all the year round; two acres in vines; two acres apricots, plums, peaches, etc.; five acres in alfalfa, which will support all the cows and horses he needs, and a few sheep for mutton besides."

The farmer supposed in this case does not go out in a colony, and devotes himself mainly to wheat-raising instead of fruits. The writer goes on to say that wherever wheat is largely grown in California "there are people at the harvest who go about with headers and threshers, and get in the crop at a reasonable price, so that the small farmer does not need tools for this." Another farmer furnishes a full detail of the cost of raising his wheat-crop for 1880, and the actual profit upon it, per acre. Every item of cost is put down, even to four cents for twine and three cents for "bluestone, to prevent smut." The cost of the land was $25 per acre, and interest upon this at 10 per cent. is reckoned among the expenses. The entire cost of the crop per acre was as follows:

Interest upon land	$2.50	Heading	$1.87
Use of water and irrigation	1.50	Threshing	2.56
Ploughing	1.13	Board of threshers	33
Seed (56 lbs. per acre)	67	Sacks (at 10 cents)	1.47
Bluestone (to prevent smut)	3	Twine	4
Sowing broadcast	10	Hauling	75
Harrowing (twice)	35	Total per acre	$13.30

The yield was 33 bushels per acre, and the crop was sold for 87 cents per bushel, or at the rate of $28.71 per acre; from which deduct the entire cost, $13.30 per acre, and there remains a net profit of $15.41 per acre. This farm was located in Tulare County, in almost the southern extremity of the State; and the wheat, having to be conveyed a long distance to market, brought 16 per cent. less than the average price throughout the United States. Yet, owing to the large yield (no larger, however, than the average yield in England), the value of the crop per acre, and on the spot, was considerably more than double of the average for the whole United States, while the cost of growing and harvesting could have been but little more per acre. Undoubtedly this land was naturally of the best for wheat; but it was no better than that of England has been brought to be by skilful cultivation, and no better by nature than that of the best parts of the central wheat-raising sections, which do not, as cultivated, yield more than half as much per acre.

But the colony system affords so many advantages that it would appear advisable whenever it can be applied—not merely in California, but in all the newer States where sections of land are still to be had. Mr. Nordhoff gives the following sketch, which, in all essential features, is as true of Minnesota and Nebraska as of California:

> "It is an advantage of the settlement of small farmers in colonies that they attract the best quality of labor. In all which I have seen a part of the population consisted of men of small means—sometimes of no means at all—desirous to build themselves little homes, and who knew by experience that their labor and that of their teams would be in constant demand. I have come across many cases where an industrious German or Swede (oftener than an American) was paying for a twenty-acre farm by the labor of himself and his span of horses, his wife and children taking care of a few acres of grapes or trees till they should come into bearing; the vegetable garden, the chickens, the pig, and the cow, which fed upon an acre or two of alfalfa, supplying ample food for the family. Such men are certain to be comfortable and permanently prosperous after a few years."

The ranks of the farmers are being constantly filled up from the agricultural laborers, in the same way as the number of master mechanics and manufacturers is recruited from journeymen and operatives. There is, indeed, far more reason why an ambitious and capable laborer should resolve upon becoming a farmer than an ambitious and skilful mechanic should become an employer. The mere laborer can never earn more than moderate wages; the skilful artisan always earns much more, the amount varying, indeed, very considerably with his skill in his special craft. Hence it is that, while the number of farm-owners exceeds that of all others engaged in farming, the number of proprietors of manufacturing establishments is much less than the number of skilled mechanics, artisans, and operatives.

Although it is comparatively easy for a man to start himself as a farmer, yet a success which involves anything more than a mere tolerable subsistence demands more wide, practical knowledge than is required in almost any other sphere of effort. The lawyer, physician, clergyman, teacher, engineer, or scientist needs, indeed, a longer and more elaborate preparatory training than the farmer does before he can enter upon the exercise of his vocation. But it may be fairly questioned whether either of them can find profitable scope for so great a number of faculties.

CHAPTER XIII.

AGRICULTURAL SUMMARY FOR 1881, 1882.

THE foregoing chapters show the condition and apparent prospects of the agricultural industry of the United States down to the close of the Census year (June 30) 1880. The data have been drawn mainly from the Census Reports of 1870 and 1880. The subsequent admirable Reports of Mr. George B. Loring, U. S. Commissioner of Agriculture, enable us to present a similar *resumé* for the years 1881 and 1882. The statements for these years, though in some respects less favorable, are fully as valuable, and upon the whole nearly as encouraging as those for the preceding decade.

The year 1880 marked the close of a period of five years of great agricultural prosperity; the year 1881 was one of marked depression. This country has never undergone such a general failure of crops as to involve any lack of a full supply of food; but the year 1881 would have approached very nearly to this had there not been a large surplus left over from the two preceding years of plenty. There had previously been years in which one or the other of our two great cereal crops had been deficient, while the other was good. In 1869 corn was a comparative failure, but the yield of wheat was above the average. In 1874 there was an average wheat crop, while that of corn was the worst ever known until 1881. In 1875 the case was reversed—the wheat crop was very much below the average, while that of corn was somewhat above it. But in 1881 all the cereals, excepting oats, suffered severely, as also did potatoes and cotton.

The winter of 1880–81 was severe, and the ensuing spring was cold and backward. Then came an unusually hot summer, marked by droughts of exceptional severity, extending over nearly the whole country. The records of the Signal Office at Washington present a fair representation of the weather in nearly every section of the United States. In May and June, 1880, the average mean temperature at Washington was 72.8°, and the rainfall was 6.89 inches, well distributed in three rains —May 11, May 23, and June 13. In May and June, 1881, the average mean temperature was 69.4°, and the rainfall was 7.57 inches, of which 5.71 inches fell in June. In July, August, and September, 1880, the mean temperature was 73.4°, and the rainfall was 9.37 inches. In the same months of 1881 the mean temperature was 76.9°, while the rainfall was only 4.93 inches, of which 2.19 inches, or nearly half, fell in September. Thus, in 1881 the difference between the extremes of the mean temperature of the five months was 7.5°; in 1880 it was only .06°. The rainfall of those months of 1880 was 16.36 inches, fairly distributed throughout the growing season; in 1881 it was 12.50 inches, of which 8.90 inches, or 71.2 per cent., fell in June and September, and only 2.74 inches, or less than 22 per cent., in July and August, which were, therefore, months of extreme drought.

The general result of this unfavorable season, as compared with the preceding favorable one, was: in 1881 there were 123,388,070 acres sown in cereals, and the total yield was 2,066,029,570 bushels, or 16.6 bushels per acre; while in 1880 there were 120,926,286 acres, yielding 2,718,193,501 bushels of all grains, or 22.2 bushels per acre—a decrease in 1881 of 25.6 per cent. in the average yield per acre, or of 24 per cent. in the total production. The effect of this decrease in production upon prices of all farm productions, including live-stock, will be considered hereafter. We will now consider each crop separately.

Corn.—In 1880 there were 62,317,842 acres planted in corn, which yielded 1,717,434,543 bushels—an average of 27.6 bushels per acre. In 1881 there were 64,262,025 acres, yielding 1,194,916,000 bushels, or 18.6 bushels per acre—a decrease in 1881 of 522,518,543 bushels, being 27 per cent. in absolute quantity, or 32 per cent. in the yield per acre. The price of corn was increased in a ratio higher than was that of the decrease of quantity. In 1880 the average price, as stated by the Commissioner of Agriculture, was 39.6 cents per bushel; in 1881 it was 63.6 cents—an increase of 60 per cent.; so that the entire value of the corn crop of 1881 was put down at $759,482,170, that of 1880 being $679,714,499—an increase in 1881 of $79,767,471, or 11.4 per cent.

The exportation of corn is so small—being not more than 6 per cent. of the whole crop—that it has no perceptible influence upon the market value; but an increase of price at home greatly reduces the quantity exported. A small proportion of the corn is exported in the shape of meal. Reducing this to its equivalent in bushels of corn, we find that of the crop of 1880, the home value being 39.6 cents per bushel, there were exported 93,648,147 bushels; the value at the place of export being 55.5 cents per bushel, its export value was $51,972,869. The deficiency in the crop of 1881 raised the home price to 63.6 cents per bushel, and of this crop the export (in 1882) was 29,840,031 bushels; and the export value being 67.5 cents per bushel, its value was $29,840,031.

Of the corn crop of the United States not more than one-fourth is used for human consumption and for seed, the remainder being used as food for live-stock, especially for swine. An increase of price, therefore, acts immediately upon the price of animals for slaughter. The diminution in quantity in 1881, and the increase in price, raised the average price of swine sold for packing by more than 31 per cent. It also increased the price of beeves, but not in as great a ratio, since they are the growth of three or four years—not of a single season—and are the product of grass rather than of corn. This point will be farther touched upon when speaking of live-stock. (Perhaps we may get estimates for 1883 in time to append them.)

The corn crop of 1882, though much better than that of 1881, was still considerably below that of 1880. According to the careful estimate of the Commissioner of Agriculture it amounted to 1,624,917,800 bushels, against 1,717,434,543 bushels in 1880, and 1,194,916,000 in 1881. The average yield per acre in 1882 was about 25.5 bushels per acre, against 27.6 bushels in 1880, and 18.6 bushels in 1881.

WHEAT.—The wheat crop of 1881 was very deficient, when compared with that of 1880, although not to as great an extent as that of corn. In 1880 there were 498,549,868 bushels grown upon 37,986,717 acres—an average of 13.1 bushels per acre. In 1881 there were 380,280,090 bushels grown upon 37,709,020 acres—an average of 10.1 bushels per acre, being the lowest yield ever reported for the whole country. The decrease in 1880 was 118,269,778 bushels, or 22 per cent. The average price in 1880 was 95 cents per bushel, the total value of the crop being $474,201,850; the average price in 1881 was $1.19 per bushel, the total value of the crop being $453,790,427—a decrease in 1881 of $20,411,423, or 4.3 per cent.

For several years from three to four tenths of the wheat crop of the United States has been exported to Europe, and this large foreign demand very much influences home prices. Of the crop of 1880 there were exported 186,331,514 bushels (including flour, reduced to its equivalent in grain), the export value being $212,745,742, or $1.14 per bushel, and the farm value at home 95 cents. Of the crop of 1881 there were exported 121,892,389 bushels, the export value being $149,304,773, or $1.22 per bushel, the farm value at home being $1.19.

The wheat crop of 1882 was a fair one, the yield being about 12 bushels per acre—about midway between the unusually good yield (13.8 bushels) in 1879 and the unusually bad one (10.1 bushels) in 1881; the average of the ten preceding years being 12.2 bushels. There was an increase in the area of cultivation, especially in the Southern States, amounting in all to about 4,000,000 acres, the entire yield of the year being about 503,000,000 bushels—an increase in 1882 over 1881 of 32 per cent., and a very slight increase over 1880. That the yield of wheat per acre is far less than it should be is undeniable. The Report of the Commissioner of Agriculture embodies some valuable suggestions upon this point, which will be presented in a separate chapter.

OATS.—This is the only one of our grain crops which was not seriously impaired by the unfavorable season of 1881. In 1880 there were grown 417,885,380 bushels upon 16,187,977 acres, the average yield being 25.8 bushels per acre. The value of the crop was $150,243,565, at 36 cents per bushel. In 1881 there were grown 416,481,000 bushels upon 16,831,600 acres, the average yield being 24.7 bushels per acre. The value of the crop was $193,198,970, at 46.4 cents per bushel—an increase over 1880 of 28.7 per cent. This great increase in the price of oats was owing to the deficiency of the corn crop, these two grains being used interchangeably for the feeding of certain species of live-stock. The oat crop of 1882 was a remarkably good one; the acreage was considerably increased, and the total yield was 475,655,700 bushels—an increase over the preceding year of 14 per cent.

Barley.—Of this there were grown, in 1880, 45,165,346 bushels upon 1,843,329 acres, the average yield being 25.5 bushels per acre. The value of the crop was $30,090,742, at 66.6 cents per bushel. In 1881 there were grown 41,161,330 bushels upon 1,967,510 acres, the average yield being 20.9 bushels an acre. The value of the crop was $33,862,513, at 82.3 cents per bushel—an increase in 1881 of 12 per cent. Barley is the only grain which is imported into the United States. The annual consumption for the last ten years has averaged 42,000,000 bushels, of which 6,000,000 bushels per year has been imported. The value per acre of the barley crop is greater than that of any other grain. The average value per acre for the last ten years has been: barley, $16.14; wheat, $12.82; corn, $11.20; rye, $10.03; oats, $9.98. The crop of 1882 was about 45,000,000 bushels—several millions of bushels less than the consumption, the deficiency being supplied from Canada. There seems no good reason why the cultivation of this grain should not be very considerably extended. Barley and rye form the principal bread-stuff of the peasantry of Northern and Central Europe, with whom wheaten bread is almost unknown. It is not probable that barley will, to any great extent, take the place with us of wheat as a bread-stuff; but, apart from the increasing demand for brewing, it is worth trying how far it may profitably take the place of oats and corn for fattening live-stock. Its average yield in bushels per acre is less than that of oats, but the weight per bushel is greater.

Rye.—The actual cultivation of rye is much larger than appears in the statistics of the Census. In the South it is largely grown as green fodder for cattle, little more being allowed to ripen than is required for seed. Elsewhere the grain is used mainly for distilling. The average yield per acre is more than that of wheat, but the value per acre is less, the average for ten years being $10.03. In 1880 there were grown 24,540,829 bushels, upon 1,767,619 acres, or 13.9 bushels per acre, the value being $18,564,560, at 75.6 cents per bushel. In 1881 there were grown 20,704,950 bushels, upon 1,789,100 acres, or 11.6 bushels per acre, the value being $19,327,415, at 93.3 cents per bushel, an increase in value, in 1881, of nearly 24 per cent.

Buckwheat ranks lowest among our grain crops. The crop of 1880 was the largest ever grown. In that year 14,617,535 bushels were grown, upon 822,802 acres, or 17.7 bushels per acre, the value being $8,682,483, at 59.4 cents per bushel. In 1881 there were grown 9,486,200 bushels, upon 828,815 acres, or 11.4 bushels per acre, the value being $8,205,705, at 86.5 cents per bushel—a decrease in quantity, notwithstanding a slight increase in acreage, of 72 per cent.; and a slight decrease in total value, although the price per bushel advanced 46 per cent.

Potatoes.—The experience of 1881 furnishes a striking illustration of some of the peculiarities of this crop. Nothing in agriculture is so uncertain as the yield per acre, or the price per bushel. In 1875 the yield was 166,875,000 bushels, or 110.5 bushels per acre; the value was $65,019,000, or 38.9 cents per bushel. In 1876 the yield was 124,827,000 bushels, or 67.2 bushels per acre; the value was $83,861,000, or 67.1 cents per bushel. In 1879 the yield was 181,626,000 bushels, or 98.9 bushels per acre; the value was $79,153,000, or 43.6 cents per bushel. In 1880 the yield was 167,659,000 bushels—91 bushels per acre; the value was $81,662,000, or 48.3 cents per bushel. In 1881 the yield was only 109,145,000 bushels, but the value was $99,291,000, or 90.9 cents per bushel. Thus, while the crop of 1881 was 35 per cent. less than that of 1880, its value was 22 per cent. greater, the price per bushel being 88 per cent. higher; and, moreover, 8,800,000 bushels were imported from Scotland and Ireland, at a cost of $4,700,000. That is, potatoes from Glasgow or Belfast could be landed at New York for 54 cents a bushel, while the home product was costing 91 cents per bushel. Of course, the possible supply from these sources was limited. But, while the quantity and price of the crop are so uncertain, there is a remarkable uniformity in the average value per acre. The average for eight years was $46.93, the highest being $54.83, in 1875; the lowest, $41.14, in 1878. "Small as was the crop of 1881," says Mr. Dodge, the statistician of the Agricultural Bureau, "the average value per acre was $48.63, which has not been exceeded by any season since 1874, illustrating the fact that partial failure of a crop does not reduce the total income derived from it. But, while this is true as a rule, it does not mitigate the hardship of individual losses, which are distributed among the careless and unskilful farmers, the enterprising cultivators usually getting good crops and high prices, reaping rewards instead of suffering damage." Quite recently a movement has begun which promises to work a great change in the production of potatoes, rendering it quite as much a Southern as a Northern crop. Mr. Dodge says:

"The reduction of the supply in 1881, and the unprecedented high prices which followed such a failure, stimulated effort, and the result was an increase of acreage of about 7 per cent. This crop is becoming more important than ever before in the South, where potatoes have formerly been grown very sparingly in gardens only, and used for a few days or weeks in the spring as a vegetable of positive rarity. Their use has increased of late, and their shipment North is increasing with the development of railroads and the tendency to 'trucking.' But it is a lesson that has been well learned, that garden vegetables, roots, and the small grains—all products which flourish in higher latitudes—must be grown in autumn, in winter, or early spring, before the heats of summer reach their greatest elevation. So potatoes are planted on the Gulf coast in December or January; a little farther north, at a somewhat later date, adapting the time of ripening to the close of the season's moderate temperature.

"And there has sprung up a practice which renders it possible to increase immensely the consumption at the South of this valuable food-product, which cannot endure the heats of summer. This practice should give the Irish potato

"A FIELD BOUQUET."

See Note 8.

a place by the side of the sweet-potato as a winter food for every day's consumption. It is by late summer planting and early fall growth, ripening before frost, that this desirable result can be attained. In high latitudes and elevations there has been some difficulty in getting an autumn crop fully matured. By making two crops—one in winter and early spring, the other in autumn—it is possible to have a continuous supply, and seed-potatoes grown at home, instead of being brought from the North, as formerly."

HAY.—"The grass crop, green and dry," says Mr. Dodge, "is worth more than any other in this country. The hay is worth far less than the pasturage in intrinsic value. Grass depastured forms an overwhelming proportion of the growth in flesh of all animals, and bears an important part in the fattening or furnishing of beeves." The hay crop was the only one which in 1881 exceeded in quantity that of 1880. In 1880 there were 31,925,233 tons, grown upon 25,864,955 acres, or 1.23 tons per acre; the value was $371,928,964, at $11.65 per ton; the value of the hay per acre being $14.38. In 1881 there were 30,888,700 acres—an increase of 5,023,745 acres, or 20 per cent.; the yield was 35,135,064 tons, or 1.14 tons per acre; the value was $415,131,366, at $13.43 per ton—an increase of nearly 12 per cent.; but there was a decrease of 7.5 per cent. in the yield per acre, and the value of the product was $13.43 per acre—a decrease from 1880 of nearly 7 per cent. Leaving out of view the grass consumed as pasturage, the hay crop stands third in value of all in the United States, being exceeded only by corn and wheat. Wheat, indeed, exceeds it by less than 7 per cent.; the average value of the wheat crop for the eleven years ending in 1881 being $359,000,000, and that of hay $335,000,000. The value of the cotton crop of 1881 was $259,000,000; that of hay, $415,000,000; the value of the hay was $156,000,000, or 37 per cent. greater than that of the cotton.

There is every reason to anticipate a very large increase in the production of hay in most sections of the country. This is prefigured by the increase of acreage in 1881 of 10 per cent. The suggestions of the Agricultural Statistician in regard to the "Winter Feeding of Farm Animals," which we reproduce greatly abridged, are worthy of the utmost consideration:

"It has long been a question with thoughtful observers, whether the manurial remainder of hay, straw, and corn-stover fed during the winter may not be the only profitable result of the winter's feeding. This material represents some hundreds of millions of dollars in value, and it is saved with much labor and expense, and 'fed out' daily for some five months in the year in middle latitudes. Comparatively little of it does more than keep up animal heat, acting as fuel in the animal furnace, but not as a flesh-former.

"To ascertain the results of prevailing practice, and learn whether this loss is a necessity or a blunder, an inquiry was instituted as to the average increase in the weight of stock two years old and upwards during the season of winter feeding. The returns show clearly and conclusively that—

"1. A considerable percentage of stock fed actually lose in flesh and in weight. 2. Another large fraction maintain their weight, and add to bone and size of frame, but decrease in flesh. 3. A small proportion make increase of weight—5, 10, 20, or 30 per cent.—depending upon comfortable shelter, and amount and variety of feed.

"The difference between a loss of 5 or 6 per cent. and a gain of equal proportion, say 100 pounds in the northern belt, in which winter feeding is a general necessity, is equivalent, at the low average rate of $3 per hundred, to more than $50,000,000. This amount could easily be made if only a part of the difference between average neglect and skilful feeding were obviated."

In New England, New York, New Jersey, Pennsylvania, Maryland, and Delaware a gain is reported, averaging about 10 per cent.; but there the cattle usually have more or less grain fed out to them. In Ohio "the verdict is, that cattle well protected and properly fed gain in flesh and in weight in winter; if unsheltered and fed on coarse hay and straw, they will lose." In Indiana "farmers report a gain in cases of good and judicious feeding; yet the majority state, as an existing fact, that the cattle lose in weight." In Illinois, "the centre of cattle-feeding in the United States, it is evident from the returns that, with the exception of the herds of professional feeders, cattle make little actual gain in weight during four months in winter, and that in many instances there is a serious loss in condition, which further impairs the capacity for gain under the best conditions of summer pasturage." In the Southern States, where the cattle are left mainly to take care of themselves through the winter, there appears to be a general loss in weight during the winter; a loss which might not only be obviated, but turned into gain, by giving them a comparatively small quantity of hay, much as grain is given to them in more northern States. And it is here that we are to look for a marked increase in the production of hay. The Report continues:

"The gain is very little in Virginia. Some counties report a loss; others say the cattle about 'hold their own' in winter; a fair average of the somewhat indefinite returns scarcely exceeds 5 per cent. The gains and losses about balance each other in North Carolina; the cattle have lived through the winter. It is not much better in Georgia. Some report a loss in flesh and weight; others maintain a *statu quo;* while a few assert a small gain. In Texas, cattle 'sometimes lose and sometimes gain,' or 'merely live;' and in some cases they are not fortunate enough to live. It is rather a loss than a gain in Arkansas. 'If well fed they will gain 20 per cent.,' say several reporters; 'but they are not well fed, as a rule, and so the actual result is a loss of 20 per cent.' The California returns indicate a loss in winter under the treatment usually practised; at the same time the claim of possible gain is distinctly made; and in Fresno County it is asserted that, with good feeding, the gain is greater in winter than in summer.

"The lesson of this branch of the investigation is, that a large portion of the farmers of the United States do not practically realize the physiological necessity for continuous growth in the production of meat of juicy, rich, even quality; or the economic necessity of making every pound of food yield the highest possible fraction of a pound of flesh. To attain this ideal fully is not easy, even to the highest skill and ripest experience; but an approach to it in popular practice would save many millions of dollars annually."

COTTON. — The cotton crop of 1880 was the largest ever grown. The yield, upon 15,950,518 acres, was 6,589,329 bales. In 1881 there were 16,710,730 acres, an increase in acreage of 4.7 per cent.; the yield was 5,435,845 bales, a decrease of nearly 18 per cent. The value was $259,016,315. In 1882 there was a slight decrease of acreage. The planting season opened gloomily, "the temperature in April and May being low, and the moisture excessive, causing deficient stands, replanting, slow growth, and unthrifty appearance. With such conditions the aphis flourishes, and rust appears." The June report showed the lowest condition since 1874. The July report showed decided improvement, which continued increasing until the close of the picking, the yield being about 6,636,600 bales, slightly exceeding that of 1880, and the value being about $305,000,000, prices ruling low.

Prices and Prosperity.—If we had respect only to the reported values of the grain crops, the year 1881 would appear to have been a prosperous one to the farmer when compared with 1880. There was, indeed, a decrease in the amount of the crops. The yield of all the grains in 1880 was 2,718,193,501 bushels, while it was only 2,066,029,570 in 1881, a decrease of 652,163,931 bushels, or 24 per cent. But the reported values in 1881 were $1,470,948,200 against $1,361,497,704 in 1880, an increase in 1881 of $109,450,496. But there was no such actual prosperity for the average farmer, because he had comparatively little to sell, and in very many cases none at all. If one must consume all he raises, it matters nothing to him whether the selling price is high or low. Those few who were fortunate enough to have any considerable surplus for sale of course gained very largely by the advance in prices; but this advantage inured mainly to the benefit of "operators" in grain, a few of whom made immense fortunes by the misfortunes of others. As a rule, the farmers were worse off at the close of 1881 than they were at the beginning. Those classes who were purchasers and not producers of bread-stuffs and other food suffered still more severely. It cost them much more to live, while there was no corresponding increase in their earnings. The year 1881 was unquestionably a very bad one for the whole country. The encouraging lesson to be learned from the review of the experiences of 1880, 1881, and 1882 is, that so vast are the agricultural resources of the United States, and so slight is the probability of a succession of bad years, that a serious deficiency in crops like that of 1881 involves no permanent loss — none which one succeeding good year will not repair. It indeed may work an ultimate benefit by stimulating the farmers to better modes of cultivation.

Live-stock.—There is an intimate and necessary relation between the grain product of the country and the price of meat. Upon this point Mr. Dodge says:

"The course of the prices of beeves for six years past is suggestive. The Chicago market, the centre of the trade for domestic consumption and export, can furnish a sufficient history of prices. For three years, from 1876 to 1879, there was a constant decline, amounting to 20 per cent., for choice beeves. Then commenced a rise, which in three years exceeded 40 per cent., the advance moving slowly in 1879 and 1880, but much more rapidly during 1881, the increase being fully $1 per hundred of live weight during the year. But after December, 1881, the advance was extraordinary, if not unprecedented, the range for 'choice' being from $5.85 to $6.35 in January, 1882; and from $8.65 to $8.90 in June, or more than 45 per cent. advance in six months."

Taking the average between the highest and the lowest prices in January of each of the years 1876–82 we find that the Chicago prices for choice beeves were: in 1877, $5.28 per hundred-weight; in 1878, $4.70; in 1879, $4.22; in 1880, $4.68; in 1881, $5.13; in 1882, $6.20. The changes during the first six months of 1882 were as follows: January, $6.10; February, $5.88; March, $6.13; April, $6.88; May, $7.40; June, $8.77. Mr. Dodge says:

"There are several causes of this great advance, which occasioned some surprise among producers, and great consternation among consumers. The exportation of extra beeves, which commenced in 1877, and increased year by year, both as live and dead meat, is an element, but does not account for the spasmodic jumps, in the rates of the later months. Another element of equal or superior strength is the great destruction of cattle on the plains, and in the parks and valleys of the Rocky Mountains, in the winter of 1880–81, by cold and starvation, amid the drifts and severities of the unusual season. While this cause tended to stiffen prices in 1881, it is not continuously operative, as the winter of 1881–82 was very favorable, and the numbers are now [at the close of 1882] increasing rather than diminishing. The third cause, acting in conjunction with the two preceding ones, and with a cumulative effect, is the failure of the corn crop of 1881, and the high prices of feeding material: all together producing an excitement in the market that partook of the nature of a panic."

This "panic" was doubtless largely caused by speculators, who certainly took the utmost advantage of it, as is shown by the decline which set in after June, 1881. There was, however, a marked diminution in the numbers of swine, as is shown by the decrease, both in numbers and weight, of those slaughtered in the great pork-packing establishments. The number slaughtered in these establishments in 1880–81 was 16,553,662; in 1881–82 it was 14,825,810; a decrease in 1881–82 of 1,727,852, or 10.5 per cent. The percentage of loss in weight was a trifle less, being about 9.1 per cent. "These figures, however," says the Agricultural Statistician, "represent only the organized pork-packing of the country. In addition to this the farmers of the packing regions, and of the non-packing States, East and South, kill for home supply and limited neighborhood sale about two-thirds as much more in absolute weight, and in numbers slaughtered a still larger proportion," since, as a rule, the best animals are sold to the packing establishments. The entire ratio of diminution was very nearly uniform; for the Census Report puts the number of swine, June 30, 1880, as 47,681,700, and the Agricultural Statistician estimates the number in January, 1882, at 44,122,200, a decrease of 3,559,500, or 7.4 per cent.

Between June, 1880, and January, 1882, there was a scarcely perceptible increase in the number of horses, mules, and milch cows; but there was a considerable increase in the number of sheep, there being 45,016,224 in 1882, against 42,192,074 in 1880, an increase in 1882 of 2,824,150, or 6.7 per cent., the ratio of increase being less than that of the increase of population. But there has been a very marked increase in the values of live-stock. The value of all kinds, in 1880, according to the Census Report, was $1,500,464,609; in 1882, as estimated by the Agricultural Statistician, it was $1,906,467,975; an increase of $406,003,366, or 27.3 per cent. in two and a half years. The increase in the values was greatest in cattle and swine. Of the causes of this increase in cattle, Mr. Dodge says:

"Prior to 1877 the exports of stock were small, and comparatively uniform. In October of that year commenced the export of beeves of the Short-horn and other grades from Northern seaports. The cattle hitherto shipped were sent from Texas and Florida, and went mostly to the West Indies. These cattle averaged from $16 to $17 per head, and the value of the aggregated cattle exported never went much above $20 until the era of fat beeves commenced. The table of averages discloses the fact that the shipments for three months of Western cattle brought the average for 1877 up to $31.86; the next year the average was $48.69; and as the proportion of Short-horn blood increased, the average was advanced, and it stood at $77.03 in 1881. While the Long-horns of Texas averaged $16.84 in that year, Northern beeves exported from Boston averaged $99.68, or one Short-horn equal to six Texans."

The increase of values is therefore a substantial one, arising to a great extent from increase of quality; and may be looked upon as permanent, especially in the case of beeves. It shows that much has been done since 1880 in the way of improving the breeds, and confirms the conclusions which we have already drawn from the Census of 1880, to the effect that cattle-breeding is one of the most promising branches of agricultural industry. In answer to the question, "What of the future of the prices of the products of the meat-producing industry?" the Agricultural Statistician, in his report for 1882, replies:

"There has already been a decline since the commencement of the improvement of the corn prospects of 1882. While prices cannot continue to increase, and cannot be permanently maintained under full harvests, it is probable that the low rates of a few years ago will not soon prevail, if ever. The general tendency throughout the world is towards a high rate for meat, compared with other animal products, and with grain."

Agricultural and other Exports.—For the last ten years, at least, fully three-fourths of the exports from the United States have been the direct products of agriculture—mining and manufactures furnishing less than one-fourth. In 1874 the percentage of agricultural exports was 74 per cent.; it was 76 per cent. in 1874; 74 per cent. in 1875; 79 per cent. in 1876; 76 per cent. in 1877; 82 per cent. in 1878; 84 per cent. in 1879; 89.5 per cent. in 1880; 89.2 per cent. in 1881. The following are the specific values in 1879, 1880, and 1881:

TABLE XI.—AGRICULTURAL AND OTHER EXPORTS.

Products.	1879.	1880.	1881.
	Dollars.	*Dollars.*	*Dollars.*
Animals and animal matter	146,640,233	161,133,376	186,258,691
Bread-stuffs, etc	210,391,096	288,050,201	270,342,591
Cotton, etc	173,158,200	221,517,323	261,267,138
Wood, etc	20,122,967	21,143,142	23,915,724
Miscellaneous agricultural	53,843,026	46,018,575	46,407,608
Total agricultural exports	604,155,522	737,862,617	788,191,752
Total exports	717,093,777	823,946,353	883,925,947
Per cent. of agricultural exports	84	89.5+	89.2−

CHAPTER XIV.

OPPORTUNITIES FOR IMPROVEMENTS IN WHEAT-GROWING.

THE average yield of wheat throughout the United States for the eleven years 1871–81 has been only 12.2 bushels per acre, never rising to 14 bushels in any year; and the average value of the crop being only $12.82 per acre, the highest being in 1877, when it was $15.27, the price being good ($1.08 per bushel), and the yield also above the average. This small average yield, when compared with that of some other countries, and with that of a few sections of our own, is sufficient proof that our wheat-growing is very defectively carried on.

The Report of the Agricultural Statistician, embodied in that of the Commissioner of Agriculture for 1881–82, contains suggestions upon some points which are worthy of the most careful consideration. We give the substance of these, preserving, as far as possible, the language of the author, but with much abridgment and condensation:

Wheat is sown either broadcast or in drills. On the Pacific Coast the drill has only a limited use. In the twenty-four States which produce nearly all the wheat grown east of the Rocky Mountains about 57 per cent. (14,000,000 acres) are seeded with the drill, and 43 per cent. (10,000,000 acres) are sown broadcast, mainly by hand. Of nearly 700 counties from which reports were received, says Mr. Dodge, "five out of six favored the use of the drill; and, as a rule, those who preferred broadcasting gave no reasons for it, simply acquiescing in the prevailing custom of the region." He thus summarizes the essential arguments for drilling, as set forth by those correspondents who favored it:

"It is claimed for the drill: 1. That it tends to clear the surface of obstructions and irregularities, turns the weeds and the refuse of the preceding harvest under, and makes a suitable preparation of the soil. 2. It enables the grower to place fertilizers in close proximity to the seed, thus stimulating a vigorous, early growth, till the roots reach out for nutriment to sustain the processes of the later development, tillering and perfecting the grain. 3. Less seed is required, saving half a bushel per acre, which would amount to nearly 20,000,000 bushels were the entire area of wheat drilled. 4. The grain is put in more evenly; its depth is regulated to reach a requisite degree of moisture, promotive of prompt germination, and to secure ample growth and firm footing of the roots, and better winter protection. 5. The plant starts more uniformly, makes a more even growth and regular stand. In a drought, if deeply planted, it comes up more quickly than the surface-planting, which requires rain before germination, and stands better in after-growth during a dry season. 6. Drilled land is better drained in winter; the disintegration of the furrow-sides furnishes food and protection to the plants; the depression catches and holds the winter snows; while the ridge protects against the wintry winds. 8. Drilled wheat usually yields more to the acre."

The last is the essential matter, involving substantially all the rest, and concerning it Mr. Dodge says: "There are few exceptions to this statement, occurring only where conditions are favorable to the growth of grain sown broadcast. The Census for 1880 shows about 50 per cent. higher rate of production in the winter-wheat districts of the Ohio Valley, where the use of the drill is general, than in the spring-wheat region, where its use is limited." He, however, adds this proviso: "How much of this difference is due to the prevalence of drilling may not be exactly determined." His own summation of the whole matter is as follows:

"The question of drilling or broadcasting is virtually one of good or bad husbandry. Where the soil is in good tilth, high fertility, and free from such obstructions as rocks or stumps, the preference expressed is almost invariably for drilling. In those districts in which custom follows corn with wheat, the corn is cut and stooked early; the shaded soil is moist, and, after stirring the surface and breaking the weeds with the harrow or the cultivator, the seed is sown, and usually comes up and produces a fair growth. With preparation so hasty and superficial, drilling is impracticable, and broadcasting a necessity. So in the weedy wheat-fields of primitive soils, given year after year to wheat-growing, the land is cheap and the labor dear, and the surface yearly becomes more and more weedy, making drilling inconvenient and expensive. Then there are wooded districts, where stumps for some years prevent the use of the drill; and in the Eastern fields rocks are sometimes troublesome; while on steep mountain slopes, as in the Alleghanies, drilling is inconvenient and little practised. The most plausible reason for broadcast sowing is given in some flat prairie districts, where surface-water will not drain off, filling the drill-furrows, freezing and destroying the plants. One correspondent strikes the key-note of primitive Western wheat-growing in recommending 'drilling when land is clean, and broadcasting when land is foul.'"

We have elsewhere called attention to the subject of selecting the wheat used for seeding. But there is much more which may be done than the mere selection of some "accidental" variety and perpetuating it. It has now come to be a recognized fact that the "breeds" of wheat may be improved by judicious "hybridization"—or, rather, *crossing*—with just as much certainty as the breeds of live-stock can be thus improved.

During the winter of 1880–81 a meeting of agriculturists was held at the Department of Agriculture, in Washington. Before this meeting a paper upon cereals was read by Professor A. E. Blount, of the Colorado Agricultural College. He gave a detailed account of his experiments with wheat, and his success in improving by selection, and in producing new varieties by crossing, illustrating the same by forty samples of wheat which he had grown. A portion of this paper appears in the Report of the Commissioner of Agriculture. The objects aimed at by "hybridization" are to "make the offspring better in quality and quantity, both for the farmer and the miller;" and the results attained are thus set forth:

"1. It improves the *plant* in various ways. It makes it more vigorous, and less liable to the attacks of vegetable parasites; the straw is stiffer, better glazed, and more healthy; the leaves, as well as the roots, are better feeders; the glumes are more compact and better filled; the heads longer; and fertilization takes place much more surely and successfully.

"2. It improves the *grain;* makes it more plump, heavier, harder, consequently better suited for milling purposes; the bran is thinner, more free from fluff and cellulose, the two obstacles that interfere so materially with milling; the grain is entirely transformed, being made to contain more or less gluten, starch, and other elements that make good flour."

We give the substance of the remarks of Professor Blount respecting some of the species of which he speaks with special favor. Wheat is said to have poor milling qualities if the percentage of gluten is small.

"The *Black-bearded Centennial* came originally from New South Wales. It is an enormous feeder and an enormous yielder, 2 ounces producing last year 25 pounds 6 ounces—202 for 1. It has the finest head and kernel of any I have ever handled. It took the premium last August, in New York, over two or three thousand competitors, for being the heaviest, an average head weighing 107 grains troy, while the next heaviest weighed 92. But, from the analysis of its composition, it cannot be said to be a good milling wheat.

"The *Eldorado* is an improvement on the old Egyptian wheat, otherwise called Pharaoh's wheat, Seven-headed wheat, Mummy wheat, etc. In Lorimer County, Colorado, it has produced 90 bushels per acre.

"The *Judkin* is a Pennsylvania wheat, and comes to us as one of the best winter varieties. I turned it into a spring wheat three years ago, since which time it has proved to be among the best. It produces, in weight, a little more grain than straw, and yields more than 320 from 1. Its color is red, and remarkably uniform. It has a strong, stiff straw, a little too long, and has good milling properties.

"While the *Australian Club* exhibits in the analysis poor milling qualities, it is one of the most prolific and successful varieties for the farmer. It produced, last year, 416 from 1, and has straw, color, and grain that can hardly be excelled. It came from Australia. It is hard, and has a large amber kernel.

"The *White Mountain* comes to me from Montana. I have raised it but one year. It has a stiff, strong straw, does not rust, and ripens evenly. It yields abundantly. I received 101 pounds from 4 ounces' sowing—404 from 1. The analysis shows its milling properties to be good. It is a smooth, white wheat, of great value.

"The *Perfection* was received from Palestine last year under a variety of names. Half an ounce produced 7 pounds of straw and 6 of grain—192 from 1. The straw is coarse, strong, and stiff; the grain is large, white, and uniform in color. It does not appear to be subject to rust or smut in this climate. Its milling properties are fair. On the whole, it is a good wheat for the farmer and miller.

"The *Russian* came to me from Moscow three years ago. Three years' test makes it one of the best wheats I have. It has one failing—shelling too easily when cut too ripe. Aside from this fault, it commends itself to every farmer, and especially to every miller, as its flour is of the best. It produced 76 from 1, the first year; 172 from 1, the second year; and 448 from 1, the third year.

"The *Rio Grande* is the best for milling of all the varieties I have. Like the Russian, it shells badly, being clad with but a single glume. Sometimes the grain grows without any natural covering at all. I have crossed it upon the Champlain, the effect of which has given every kernel in the offspring its proper amount of clothing—two glumes, two palets, and two lodicules.

"The *Touzelle* was obtained from France. It is the finest-looking of all the French bearded wheats, and improves rapidly by selection and cultivation. It produced 56 from 1, the first year; 128 from 1, the second year; 480 from 1, the third year. The analysis shows that it is not yet a good milling wheat, being destitute of the proper percentage of gluten.

"The *Sonora* came from Mexico, below the Gulf of California. Some millers do not like it, and some farmers will not raise it. I have raised it for three years; the first year it produced 56 from 1; the second year, 126 from 1; the third year, 416 from 1. It is a good wheat if cultivated with some care, and milled properly.

"The *Improved Fife* is an improvement on the Saxon Life, and commends itself to every one who has seen and raised it. It has for three years showed no failing whatever; and the analysis shows it to have the best milling properties. The first year I raised 56 from 1, on the College grounds; the second year, 126 from 1; the third year, 416 from 1.

"The *Lost Nation* is an old 'stand-by' in the Eastern States. Seed was sent to me three years ago from Chester County, Pennsylvania, and the three tests I have given it show it to be an excellent variety for the farmer, and the analysis shows it to be a pretty fair milling wheat. The first year it produced 76 from 1; the second year, 96 from 1; the third year, 352 from 1.

"The *Clawson*, from Pennsylvania, is a winter variety, and almost refuses to be transformed into a spring wheat. It has done well, and commends itself to the farmer, being very prolific, and free from almost all diseases and accidents. It does not 'kill out' in the winter, but grows well, and is green all the time, no matter how cold it is. The straw is strong, well glazed, and never fails; the heads are remarkably long, and always well filled. The first year it produced 68 from 1; the second, 136 from 1; the third, 544 from 1."

Prof. Blount exhibited several specimens of his own hybrids, of some of which he says: "They are but two years old, and hence have not become 'fixed.' I crossed them in order to make the offspring better in quality and quantity, both for farmer and miller." Of some of his hybrids he makes particular mention:

"My *Number Ten*—a cross of the New York Diehl upon the Virginia Golden Straw—now three years old, is 'fixed,' and so far claims the attention of all who see the grain or straw. Its milling properties, as shown by the analysis, speak for themselves. It has a stiff, strong straw, has not rusted at all, and the head is one of the finest and largest known; more than 100 kernels are found in a large proportion of them. The wheat came from but one kernel planted in 1880; that one kernel produced the first year five good heads containing in all 474 kernels; these I planted again in 1881; and I have now 30 pounds or more, which will produce at least 50 or 100 bushels by careful sowing and cultivation."

Prof. Blount has some timely words of caution in regard to experiments in the crossing of wheats:

"The whole operation is very similar to the breeding of stock. The experimenter must thoroughly understand the entire vegetable and physiological structure of both wheats before he can make a cross or an improvement upon either parent. A success cannot always be made the first trial, or the second. The experimenter is compelled sometimes to cross and recross again, in order to make a wheat that will suit both farmer and miller. Many wheats are splendid in the field, and are of no manner of account in the mill, and *vice versa*."

He illustrates this in the case of some of his own hybrids, of which the chemical analysis is given:

"Take Blount's hybrid *Number Eighteen*, for instance. It is a failure, so far as being fit for the mill is concerned. Why? Because the percentage of gluten (10.74) is very much less than that of its mother, the *Improved Fife* (14.23), and very little better than that of its father, the *Australian Club* (8.91). Had it been the average of both (11.57), or more, there might have been a chance of making it a success. One more trial—the third—will settle the question whether or not it is worthy to be placed among the standards. How far it is a success for the farmer remains yet to be determined. Compare Blount's hybrid *Number Nineteen*. The father-wheat, *Improved Fife*, contains 14.23 per cent. of gluten; the mother, *Oregon Club*, has 10.06 per cent.; the average (12.14 per cent.) is just what *Number Nineteen* contains. Now, both these parent wheats are good for both farmer and miller; and I have reason to conclude that this offspring will be better than either parent when it becomes 'fixed.' It is now only two years old, and will not become 'fixed,' or a standard, until next year (1882)."

It must be borne in mind that all these experiments were made in Colorado, where the climate and soil appear to be especially adapted to the growth of wheat, the yield in 1881 being 19.8 bushels per acre, while the average for the entire United States was only 10.2 bushels. And, moreover, the cultivation in these experiments was most carefully conducted in every respect. Prof. Blount says:

"All these remarks and statistics are made with respect to the climate and locality of Colorado. They may, or may not, apply to other sections and other

States. All these wheats have been improved by selection and crossing, cultivation and irrigation, under different treatment. In this, as well as in different soils and climates, they might do better, or they might do worse. I am convinced that wheats made on the ground where they are to be raised will do much better in every respect than such as may be imported."

It is not to be expected that the best seed, of the best varieties, and with the best of farm cultivation, will produce anything approaching the increase of 100, 200, 300, and even more than 400 for 1, reported as the result of these experiments; but when it is borne in mind that more than one-tenth of the wheat crop of one season is required as seed for the next—that is, that the average yield is less than ten from one—it is evident that improved varieties of seed would very greatly increase the products of our wheat-fields. There is, therefore, no reason to doubt that the growth of wheat for the sake of selling it for seed would, in the right hands, prove to be a very lucrative branch of agricultural industry, just as the breeding of cattle has become.

CHAPTER XV.

OPPORTUNITIES FOR FARM LABORERS.

IT is a distinctive characteristic of American agriculture that the majority of the cultivators are the owners of the soil which they till. In 1880 there were 4,008,907 farms, of which 2,984,386, or about three-fourths of all in number, and a much greater proportion in area and value, are occupied by the owners. There are 322,357 farms which are rented for money; and 702,244, mainly in the South, and occupied by freedmen, who cultivate them on shares upon terms varying with the fertility of the soil, the conditions as to furnishing animals and farm implements by the owner, etc. Besides farmers, there are nearly as many "agricultural laborers" who work for wages, and many others who are regularly engaged in other occupations, but work as farm laborers during the harvest and other busy seasons.

The amount of wages paid to these farm laborers is an important element in estimating the profits of the farmers, many of whom employ a large number of hands. The wages of farm laborers vary widely in different sections, and from many causes. It was not until a quite recent date that there were any reliable means of ascertaining the statistics in this matter. About fifty years ago Mr. H. C. Casey set on foot inquiries the result of which was, that the average wages were about $9 per month, with board. In 1866 the Agricultural Department undertook investigations upon a comprehensive scale, the result of which was, that the average wages were found to be $15.50 per month, with board. So that, if the two sets of data are accepted, there had been an increase of 72 per cent. in one generation. The average rate of wages, when board was not provided, was $26 per month for the whole country, and $28 in the States where white labor was almost exclusively employed.

During the next three years there was a decline to $25.13 throughout the whole country, although the rates at the South were somewhat increased. There have been numerous fluctuations of varying degrees in different sections during the succeeding years, which are set forth in elaborate tables by the Agricultural Statistician in his Report for 1882.

The year 1879 was the period of lowest depression in agricultural wages. The results of the great monetary revulsion which began late in 1873 had now fully developed themselves. The manufacturing industries were greatly depressed, and operatives thrown out of employment sought work upon farms, entering into competition with the regular agricultural laborers, and thus greatly reducing the wages paid to them. The operatives in the Massachusetts factories thrown out of work went back to their former homes in the adjacent States, and sought employment upon farms. From 1875 to 1879 the wages of farm laborers in Maine fell from $25.40 to $18.25; in New Hampshire, from $28.57 to $19.75. In all New England there was an average fall of 30 per cent.; in the Middle States, of 25, and in the Western States, of 14 per cent. In the Southern States, where the wages were low—just emerging from the no-wages of the slave system—there was comparatively little decline. After 1879 there was a gradual advance, up to 1882, of about $3 per month in all the States east of the Mississippi, although the rates of 1875 have not been reached; and in the new States beyond the Mississippi the average became higher than it was in 1875. Table XII. shows the average monthly wages, without board, paid in 1875, 1879, and 1882, to farm laborers regularly employed. Where board is furnished, the wages are lower by about one-third — sometimes a little more, sometimes a little less.

The influence of manufactures upon the prices of agricultural labor are strikingly evinced in this Table. Wherever other industries flourish they draw off many persons who would otherwise engage in agricultural labor; thus, by diminishing

RETURNING FROM WORK.

See Note 9.

TABLE XII.—WAGES OF AGRICULTURAL LABORERS.

States.	1882.	1879.	1875.	States.	1882.	1879.	1875.
Maine	$24.75	$18.25	$25.40	Arkansas	$18.50	$17.12	$20.50
New Hampshire	25.25	19.75	28.57	Tennessee	13.75	12.73	15.20
Vermont	23.37	19.00	29.67	West Virginia	19.16	16.98	20.75
Massachusetts	30.66	25.00	31.87	Kentucky	18.20	15.17	18.12
Rhode Island	27.75	23.00	30.00	Ohio	24.55	20.72	24.05
Connecticut	27.90	23.29	28.25	Michigan	25.76	22.88	28.22
New York	23.63	20.61	27.14	Indiana	23.14	20.20	24.20
New Jersey	24.25	20.22	30.71	Illinois	23.91	20.61	25.20
Pennsylvania	22.88	19.92	25.89	Wisconsin	26.21	21.07	25.50
Delaware	18.20	17.00	20.33	Minnesota	26.36	24.55	26.16
Maryland	16.34	14.00	20.02	Iowa	26.21	22.09	24.35
Virginia	13.96	11.00	14.84	Missouri	22.39	17.59	19.40
North Carolina	12.86	11.19	13.46	Kansas	23.85	20.67	23.20
South Carolina	12.10	10.25	12.84	Nebraska	24.45	23.04	24.00
Georgia	12.86	10.73	14.40	California	38.25	41.00	44.50
Florida	16.64	13.80	15.50	Oregon	33.50	35.45	38.25
Alabama	13.15	12.20	13.60	Colorado	36.50	35.00	38.50
Mississippi	15.10	13.31	16.40	Utah Territory	......	28.87	35.50
Louisiana	18.20	16.40	18.40	New Mex. Ter.	......	22.10	22.75
Texas	20.20	18.27	19.50	Dakota	......	28.56	32.50

the supply increasing the rate of wages paid upon the farm. The rates are higher in Massachusetts than in any other State east of the Rocky Mountains. Ohio and Kentucky lie side by side, with climate and soil essentially the same; but Ohio is dotted over with cities and large towns having thriving manufacturing industries, and the wages for farm labor are notably higher than in Kentucky, where there are few manufactures, and also a considerable percentage of negro labor. In the Southern States, where more than half of agricultural labor is performed by colored persons, the rates are very much lower than elsewhere—"because," says Mr. Dodge, "it is less intelligent and less efficient, and is applied mainly to a single routine of cropping; but it has been gradually and surely improving in quality, commanding appreciation, so that it now brings very nearly the same price when cotton is 12 cents per pound as when it was 30 cents." The agricultural wages in California and Oregon are altogether exceptional, the rates being more than the average earnings of mechanics and operatives throughout the United States. The yearly wages for farm labor, without board, are as follows: In the Pacific States, $458; in the Eastern States, $320; in the Western States, $284; in the Middle States, $267; in the Southern States, $184.

There are also many persons, regularly employed in other occupations, who engage in farm labor for a few weeks during the harvest, and are paid by the day. The rates of wages for this work vary greatly. They are highest in the great wheat-growing States, "because of the extraordinary prominence of a single crop, which is an absorbing specialty. The harvest in the South is a longer season, not so exacting in demands for immediate and speedy conclusion, and harvest wages are therefore lower, relatively, than the more transient service in the West." The average rates per day, without board, are: In the wheat-growing States, about $2.00; in the Eastern and Middle States, $1.60; in the Southern States, $1.20; being lower in the cotton States (except Texas) than in the others. The extremes throughout the United States are, California, $2.30, and Alabama, $1.05 per day.

There is no necessity that the man who commences life as an agricultural laborer should remain such all his days, provided he has the intelligence sufficient to enable him to become a successful farmer, and will for a few years practise the strictest frugality. It has been elsewhere shown that the farmer in a new country needs about $1000 to start with to purchase and stock a moderate farm. Now, the average yearly wages of a farm-hand (exclusive of those in the Southern States) is about $332, without board; deducting one-third for board, there remains $220; and out of this, if he has no one else to provide for, he can lay by $120 a year without denying himself any absolute necessity. Let the young man begin to do this on his twenty-first birthday, depositing his savings in a savings-bank, at 4 per cent. interest, to be added annually to the principal. His first deposit, on his twenty-second birthday, will be $120. On his twenty-third birthday he will have to his credit $124.80, to which the new deposit of $120 being added, he will have $244.80. Going on in like manner, he will have on his twenty-fourth birthday, $374.59; on his twenty-fifth, $509.75; on his twenty-sixth, $649.95; on his twenty-seventh, $795.94; on his twenty-eighth, $947.77. On his twenty-ninth birthday, including the deposit of that day, he will have $1105.68 to his credit. If he makes the deposit more frequently than once a year (and, as is the custom of savings-banks, the interest account is made up semi-annually), there will be a few dollars more than this to his credit.

Thus, at twenty-nine, the prudent agricultural laborer will have in his hands cash capital enough to set up as a farmer. Few professional men begin to earn their livelihood at that age. The qualities which have enabled him to attain these results can hardly have failed to make him a good farmer, and the path to success is as open to him as to any other man. He will during this time have had ample time and opportunity to make up his mind where he shall locate himself. Now is the time for him to marry a woman who is fit to be a farmer's wife; and, no longer a mere agricultural laborer, to begin his new life as a farmer, the owner of the soil which he tills. The ranks of successful farmers are, indeed, largely recruited in this manner from agricultural laborers.

CHAPTER XVI.

THE PRECIOUS AND NON-PRECIOUS METALS.

THE Mineral Products of the United States include the Precious Metals, gold and silver; the Non-precious Metals, iron, copper, lead, etc.; Coal, anthracite and bituminous; Petroleum, or mineral oil; and the Stones quarried for building purposes. This chapter will treat of the metals.

The Precious Metals.

Not less than one-third of the gold and one-half of the silver annually produced in the world is now mined in the United States. The value produced during the year ending May 31, 1880, was $74,490,620, of which $33,379,663 was gold, and $41,110,957 silver. The weight of the gold bullion was 1,614,741 ounces troy, or 55.23 tons avoirdupois; that of the silver bullion was 31,797,473 ounces troy, or 1090.17 tons avoirdupois. The weight of the gold was equal to five ordinary car-loads; that of the silver to about 110 car-loads. Of the gold, 64 per cent. was from deep mines, and 36 per cent. from "placer" or surface mines; and of the placer gold, 71.5 per cent. was found in California, 9.7 per cent. in Montana, 7.7 per cent. in Oregon, and 7.3 per cent. in Idaho. Of the silver, all was from deep mines except about one-fourth of one per cent., which was found as an alloy of placer gold, nearly all of it being from California.

In regard to the state of this branch of mining industry in 1880, the Census Report says:

"Although these figures are somewhat less than those reached in three or four exceptional years, they represent a yield considerably higher than the average annual product. While the Comstock lode, the former great producer of the country, has a greatly decreased output, this loss is compensated by a corresponding increase in other regions, notably in the Leadville district, Colorado. As a whole, the mining industry of the country is in a healthy state, and the product of the precious metals in the future promises to show a regular and permanent increase."

Table XIII. shows for each State the quantity and value of the gold and silver, and the total value of that produced in each State during the year ending May 31, 1880; and also the value of the yield in 1882.

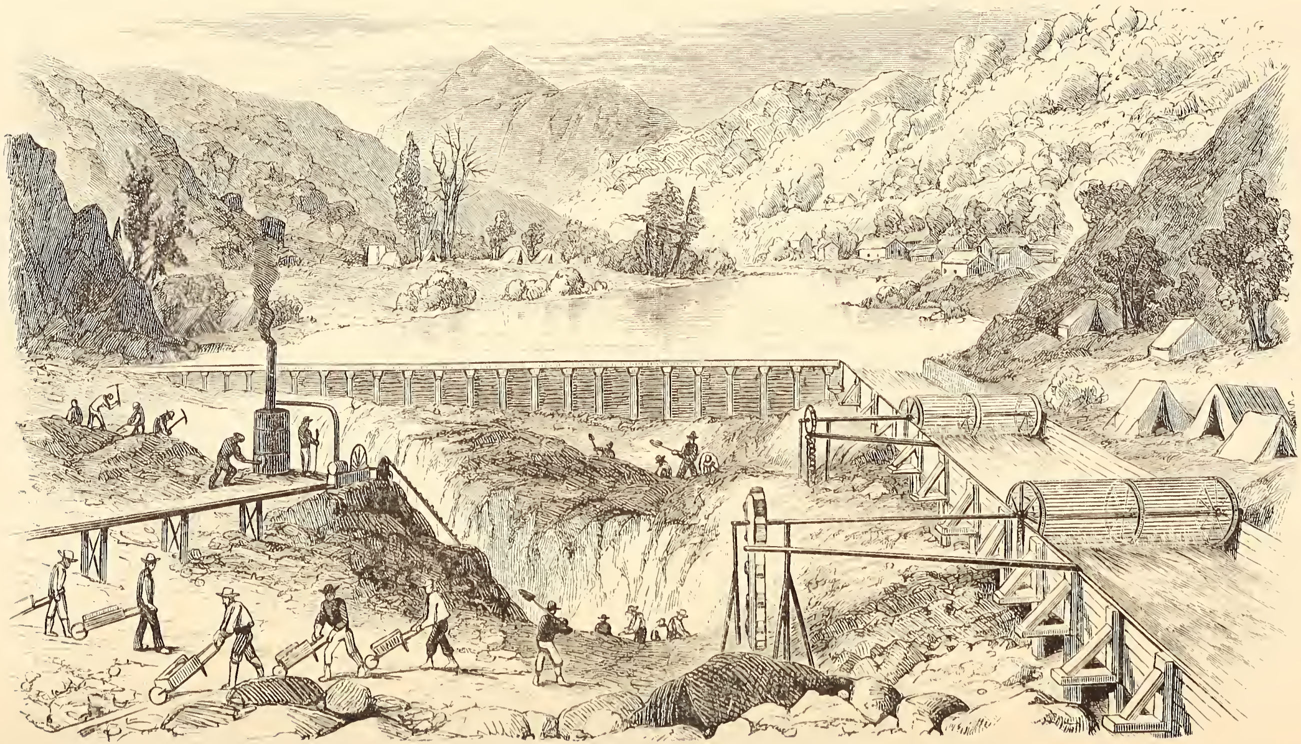
TABLE XIII.—GOLD AND SILVER—PRODUCT AND VALUE.

STATES.	Gold, 1880.		Silver, 1880.		Total, 1880.	Gold, 1882.	Silver, 1882.	Total, 1882.
	Ounces.	*Dollars.*	*Ounces.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
Alabama	62.9	1,301	....	....	1,301	....	....	....
Alaska	287.9	5,951	39.4	51	6,002	150,000	....	150,000
Arizona	10,253.8	211,965	1,798,920.8	2,325,825	2,537,790	1,065,000	7,500,000	8,565,000
California	829,676.7	17,150,941	890,158.2	1,150,887	18,301,828	16,800,000	845,000	17,645,000
Colorado	130,607.6	2,699,898	12,800,119.8	16,549,274	19,249,172	3,360,000	16,500,000	19,860,000
Dakota	159,920.1	3,305,843	54,770.1	70,813	3,376,656	3,300,000	175,000	3,475,000
Georgia	3,919.8	81,029	256.6	332	81,361	250,000	....	250,000
Idaho	71,578.2	1,479,653	359,309.1	464,550	1,944,203	1,500,000	2,000,000	3,500,000
Maine	145.1	2,999	5,569.0	7,200	10,199	....	....	....
Michigan	....	....	20,000.0	25,858	25,858	....	....	....
Montana	87,354.0	1,805,767	2,246,938.4	2,905,068	4,710,835	2,550,000	4,370,000	6,926,000
Nevada	236,468.7	4,888,242	9,614,561.3	12,430,667	17,318,909	2,000,000	6,750,000	8,750,000
New Hampshire	532.1	10,999	12,375.0	16,000	26,999	....	....	....
New Mexico	2,387.5	49,354	303,455.0	392,337	441,691	150,000	1,800,000	1,950,000
North Carolina	5,754.4	118,953	108.0	140	119,093	190,000	25,000	215,000
Oregon	53,101.3	1,097,701	21,496.2	27,793	1,125,494	830,000	35,000	865,000
South Carolina	630.8	13,040	43.3	56	13,096	25,000	....	25,000
Tennessee	96.7	1,998	....	....	1,998	....	....	....
Utah	14,105.5	291,587	3,668,565.5	4,743,087	5,034,674	190,000	6,800,000	6,990,000
Virginia	450.9	9,321	....	....	9,321	15,000	....	15,000
Washington Ter.	6,569.3	135,800	788.6	1,019	136,819	120,000	....	120,000
Wyoming Ter.	837.9	17,321	....	....	17,321	5,000	....	5,000
Totals	1,614,741.2	33,379,663	31,797,474.3	41,110,957	74,490,620	32,500,000	46,800,000	79,300,000

All gold was doubtless originally deposited in veins of rocks of different kinds, usually quartz, and associated with various other pyritous minerals; sulphate of iron, and copper and lead ores being the most common, the gold itself forming a very small portion of the metallic contents of the rock. The gold often occurs in particles too small to be visible to the naked eye, also in grains, scales, and lumps or "nuggets." The largest known nugget was found in Australia in 1852. A native, in the employment of Dr. Kerr, was strolling through a sheep-pasture, when his eye fell upon what appeared to be a yellowish lump of stone. A blow with his hatchet brought to light a mass of gold. He brought word to his master, who rode to the spot. Close together lay three blocks of quartz, which had apparently been broken apart. All of them weighed about 150 pounds, and they contained 100 pounds of pure gold, worth more than $20,000.

In the course of ages the surface of the gold-bearing rock was sunk beneath the sea, and again elevated above it, very probably over and over again in some quarters of the earth. Many portions of the surface were exposed to the same kind of diluvial action as that by which tides and waves and currents are now wasting away the rocks: pounding and crushing, and grinding them into bowlders and pebbles, gravel and sand, clay and mud. The various substances, thus more or less disintegrated, were carried along by the currents, and gradually deposited, the larger and heavier portions first reaching the bottom. If these currents acted upon gold-bearing rocks, the particles of the precious metal, being some seven times heavier than the rest, were deposited sooner than fragments of quartz of similar size. But large pieces of rock and small pieces of gold would at first be deposited together. The continued agitation by the currents would in the course of time cause the heavier metal to sink through the mass of bowlders, pebbles, and sand, until they at last rested upon a bottom of rock or clay, impervious to water, and they could sink no farther. Below this rock or clay bed no gold is found.

But very frequently the ancient beds of streams have be-



TURNING A RIVER.

See Note 10.

come dried up, or the streams have found new channels; and placer mines are often found in these dried-up beds, at a height much above the present level of the surrounding country. Placer mining consists in a great part in directing a stream of water through or against these ancient river-beds, washing away the pebbles, sand, and mud, and collecting the gold by the various processes of washing, amalgamating, etc.; all involving considerable outlay for furnishing the necessary water, and for other purposes. Practically, placer-mining is now carried on by a few large corporations, who have the means for conducting extensive and costly operations.

Nearly two-thirds of the gold, and all but an inconsiderable fraction of the silver, of the United States are produced by "deep" or "vein" mining. Here, man has to do that which Nature has done for him in placer-mining. He has to get the gold out of narrower veins diffused through the solid rock, which has not been broken up and pulverized by the elements.

The gold has been deposited in these rocks according to laws with only a few of which we have made ourselves acquainted. Quartz veins are not all auriferous. Even in gold-bearing regions there are numerous veins in which no gold has been found; and large portions of actual gold-bearing veins contain no gold. Sometimes one side of a narrow vein is rich in gold, while the other side is destitute of it. The main discovered law in respect to the distribution of gold in the veins is that it is usually found in "chutes" or chimneys, having a vertical rather than a horizontal direction. The gold-bearing portion of the vein may be only a few feet in size in either horizontal direction, and yet may extend hundreds of feet or yards downwards. It is not the length of the whole vein which determines its value, but the size and depth of these ore-chutes. Thus, in the "Eureka" quartz vein, in California, the breadth of the vein is only four feet, while the depth of the paying chute is about 1000 feet—almost one-fifth of a mile—and the main shaft has been sunk to a depth of 1250 feet. To reach this chimney at different levels, eight "drifts," or tunnels, with an aggregate length of nearly two miles, have been excavated through earth and rock. During the nine years, 1865–74, when this mine was the most productive, bullion to the amount of $4,273,148 was taken from this chute, and $2,054,000 was paid in dividends to the stockholders, after defraying all the working expenses. It was found, however, that the ore began to decrease in richness after the depth of 1000 feet had been reached. The accepted theory respecting these chutes is, that they were the channels for the exit of the primeval waters and vapors superheated to such a temperature that the gold was vaporized, and upon partially cooling was deposited in the chutes, as soot is deposited in a chimney.

The processes of deep-mining begin with digging the ore and conveying it to the surface. This differs in no essential respect from iron-mining or coal-mining. The ore has next to be crushed and pulverized by means of powerful machinery. The quantity of all the minerals is very small compared with that of the worthless vein-stone — the pyritous minerals, usually denominated "sulphurets," rarely exceeding 3 per cent.; and even of this the gold forms but a small percentage. An ounce of gold to a ton of the rock, or 34 parts in 10,000, is considered a large yield.

The extraction of this minute fraction of gold from the pulverized rock requires elaborate processes, calling for the exercise of the highest mechanical and scientific attainments. A School of Mining is now as indispensable a part of a great university as is a school of law, of medicine, or of theology; and there is certainly no department of professional activity which gives a more sure promise of the highest pecuniary success. There is certainly room for great advance in this respect, for we are assured that not less than one-fifth of the amount of the precious metals contained in the crushed ore is lost. The man or men who shall devise methods of saving any considerable portion of this enormous waste have in their hands the certainty of great fortunes.

Silver is far more widely diffused throughout nature than gold. It exists in sea-water, and it is estimated that not less than 2,000,000 tons of silver are contained in all the oceans of the globe—nearly as much as, at the present rate, would be produced from all mines in nine hundred years; but it is not probable that this will ever become available for human use. Half of the silver now produced in the world is mined in the United States; and of this half, not less than 40 per cent. is from Colorado, 30 per cent. from Nevada, 11 per cent. from Utah, and 16 per cent. from Montana, Arizona, and California. That is, three States and three Territories of the Union now produce 49 per cent. of all the silver mined in the world. To this fact, beyond doubt, is to be attributed the strenuous efforts made by European governments to "demonetize" silver, and thus to depreciate its current value as compared with gold. In just so far as we take part in these attempts, in just so far do we diminish the value of one of our great natural products.

As reckoned in the Census Report, the value of "fine gold" is about $20.70 per ounce troy, and the average fineness of placer gold is 0.876 (that is, 876 parts in 1000). The value of fine silver is about $1.30 per ounce; and the value of gold, as compared with silver, is about 15.9 to 1. Gold and silver are produced in some quantities in twenty-two States and Territories of the Union. Taking all of these together, the average production per head of the population is $5.80. The extent to which gold and silver mining is an important factor in the industry of these States can be readily determined: in Alabama, Alaska, Maine, Michigan, South Carolina, Tennessee, and Virginia, it was less than three cents per head; in Georgia, New Hampshire, North Carolina, and Wyoming, it was between three and fifty cents per head; in Washington, $1.81; in New Mexico, $3.69; in Oregon, $6.44; in California, $21.16; in Dakota, $24.98; in Utah, $34.97; in Idaho, $59.62; in Arizona, $62.75; in Colorado, $99.05; in Montana, $120.03; in Nevada, $278.14. Or, taking the average of the principal gold and silver mining States — Colorado, California, Nevada, Utah, Montana, Dakota, Arizona, and Idaho—the production of the precious metals was, in 1880, $47.91 per head of the population. These figures indicate the directions in which gold and silver mining enterprise will probably be found to meet with the best success.

The Report of the Director of the United States Mint for

1882 (Table XIII.) furnishes materials for a comparison of the product of gold and silver for that year with that of 1880. There was a decrease in gold of nearly $900,000, and an increase in silver of $5,700,000: an increase in the product of the precious metals of about $4,800,000.

The Non-Precious Metals.

Iowa produced 384 tons of lead ore, valued at $19,172; Idaho, 150,000 copper ingots; Nevada, 734,730 copper ingots; and Texas, 5,084 copper ingots, which do not appear in the table given below, but are included in the totals.

The following is from the Census Report of 1880:

TABLE XIV.—THE NON-PRECIOUS METALS (*Regular Establishments*).

States.	Iron Ore.		Lead Ore.		Zinc Ore.		Copper Ingots.	
	Tons.	*Dollars.*	*Tons.*	*Dollars.*	*Tons.*	*Dollars.*	*Pounds.*	*Dollars.*
Alabama	184,110	189,108						
Alaska							3,933	
Arizona							3,183,750	
California							720,000	
Colorado							1,578	
Connecticut	35,018	147,799						
Delaware	2,726	6,553						
Georgia	72,705	120,692					922	
Illinois			772	30,200	3,000	39,000		
Kansas			10,681	460,980	7,248	477,693		
Kentucky	33,522	88,930						
Maine	6,000	9,000					102,500	18,040
Maryland	57,940	118,050			672	7,200	30,910	
Massachu'ts.	62,637	226,130						
Michigan	1,837,712	6,034,648					45,830,262	7,979,232
Missouri	386,197	1,674,875	28,315	1,478,571	34,344	599,373	230,717	25,730
Montana T.							1,212,500	
N. H.							34,050	5,993
New Jersey	754,872	2,900,442			39,381	451,070		
N. Mex. Ter.							4,055	
New York	1,239,759	3,499,132						
N. Carolina	3,276	5,102					1,640,000	350,000
Ohio	198,835	448,000						
Oregon	6,972	4,669						
Penn	1,820,561	4,318,999			20,459	394,568	214,736	36,256
Tennessee	89,933	129,951	60	2,500	3,699	22,145	153,880	
Vermont	560	2,750					2,647,894	469,495
Virginia	169,683	384,381	11,200	33,000	10,448	24,126	678	
W. Virginia	60,371	88,595						
Wisconsin	41,440	73,000	1,728	78,525	4,617	64,562	18,087	1,549
Totals	7,064,829	20,470,756	53,140	2,102,948	123,868	2,079,737	56,920,266	8,886,295
Irregular Products		2,686,201		5,832,192		2,170,269		572,139
Total values		23,156,957		7,935,140		4,240,006		9,458,434

Iron, in a separate state, is an almost unknown metal. Its affinity for other elements is so strong that what we know as iron is virtually a compound of iron and carbon in differing proportions; and, besides carbon, there are other elements, such as manganese, phosphorus, etc., very minute proportions of which greatly affect the quality of the iron. The Census Report deals specially with the iron ores mined in 805 "regular establishments" in twenty-one States, which in 1880 produced 7,064,829 tons, valued at $20,470,756, averaging $2.90 per ton. In New Jersey the average value was $3.84 per ton; in Michigan, which produced more than any other State, the value was $3.29 per ton; in Pennsylvania, which ranked second in production, $2.49 per ton; and in New York, which ranked third in production, the value was $2.82 per ton. Besides the products of these large establishments, there were returns from numerous "farmers' mines," producing in all 909,877 tons of iron ore, valued at $2,686,201, making the entire product 7,974,706 tons: value, $23,156,957.

There were, in 1880, employed in iron-mining 31,668 persons (30,080 men and 1588 boys), an increase over 1870 of 111 per cent. The increase in tonnage of product was 108 per cent.; increase of value of product, 55 per cent. The capital embarked was increased, from 1870 to 1880, by 247 per cent. The value of the products per hand decreased 26.5 per cent., and the average amount of yearly wages paid per hand decreased 33.8 per cent. Or (as it seems should have been done), if the values for 1870 had been reduced to a gold standard, there would still be a decrease of about 21 per cent. in the values produced per hand, and a decrease of about 27 per cent. in the wages paid per hand.

These statistics show that, comparing 1880 with 1870, while the total value of the products of iron mining was largely increased, the value per ton was very sensibly decreased. This decrease is partly owing to the competition with the mining of Europe, especially that of Great Britain, where the price of labor is much lower than in the United States; so that, notwithstanding the heavy duty on iron, very large quantities are imported, and it is only by a large reduction of the rates of wages that iron mining is at all profitably carried on at present. The reports of the iron industry for 1881, 1882, and 1883 evince the same tendency.

While, therefore, the production of iron must always be a very important branch of American industry, it appears that, taking the home product and the importation together, the supply is in excess of the demand, and the business is not at present one in which it is advisable to invest additional capital, except in localities which offer exceptional facilities.

The greater part of the labor employed in mining is "unskilled" labor, and the wages paid for it rank among the lowest of all, while the work is among the most severe, and more than half of it is performed by persons of foreign birth. Of the 234,228 miners, only 107,993, or 46 per cent., were born in the United States.

Certain of the higher departments of mining industry, however, present great pecuniary inducements. Mining, engineering, metallurgy, and the whole range of sciences taught in our schools of mines, rank among the most lucrative of all professional avocations; and, unlike most of the other professions, their ranks are not over-crowded. The successful exercise of these branches demands special aptitude and earnest study, and the remuneration is in proportion.

Copper is diffused in minute quantities all over the globe. It exists in most soils, in sea-weed, and in the animal body. It occurs in ores of various compositions, and also in the form of native metal nearly pure. In the United States it is chiefly found in the latter form. It is produced as an article of commerce in twenty-one States of the Union; but 80 per cent. of all the metallic copper was mined on the shores of Lake Superior, in Michigan; and its value constituted 84 per cent. of that of the entire copper product in the United States. The copper ore found in Arizona and California results not in the production of copper alone, but in "copper matte," a mixture of copper and other metals, which is sent to the East to be refined.

There were, in 1880, in the United States, 53 "regular copper-mining establishments," employing 6258 hands (5966 men and 292 boys); the product of all of these was 1,007,245 tons of ore, yielding 56,920,266 pounds of copper ingots, the value of which was $8,886,295. Copper, valued at $572,139, was produced outside of the regular establishments, raising the entire copper product for 1880 to $9,458,434. Reducing the sum given for 1870 to a gold standard, the real increase in the value of the copper ore in 1880 was 85 per cent. This increase was owing, partly to the increase in quantity produced, and partly to the increase in value per ton. In 1870 the value of copper ore per ton was (in gold) $5.90; in 1880 it was $8.82, an increase in 1880 of more than 49 per cent. Copper ore was the only one the value of which per ton was greater in 1880 than it had been in 1870. "This increase of value," says the Superintendent of the Census, "is owing to the increase in the percentage of metal contained in the rock of the Lake Superior region, the leading mine being exceptionally fortunate in this respect."

The average yearly wages paid to copper-miners in 1870 was (in gold) $401; in 1880 it was $514, an increase of 28.2 per cent. Viewed in any aspect, copper-mining is a very lucrative and growing industry in the United States.

LEAD.—Lead and zinc are for many purposes grouped together in the Census Report; for, so far as these metals are produced directly from the ores, they come from the same mines, and are smelted in the same establishments. But nearly 60 per cent. of all the metallic lead "is refined from base bullion, the principal value of which was silver," although in quantity the lead far exceeded the silver. This lead, of course, comes from the silver-producing States.

Lead-mining, properly so-called, is carried on in seven States; Missouri, however, produces 53 per cent. of the whole, and Kansas 20 per cent. The product of ore was 53,140 tons, yielding 66,970,838 pounds of lead; value, $2,102,948. From the refining of base bullion were produced 95,967,267 pounds of lead; value, $5,832,192. The total product of metallic lead was, therefore, 162,938,105 pounds; value, $7,935,140.

ZINC.—Metallic zinc, or "spelter," is mined in nine States;

New Jersey furnishing 31 per cent., Missouri 28 per cent., and Pennsylvania 17 per cent. of the whole. The product of ore was 123,868 tons, yielding 46,477,999 pounds of metal; value, $2,079,737. Besides this, there was "of zinc oxide (produced in chemical works from the ore, 20,213,631 pounds), equivalent to 16,203,460 pounds of metallic zinc;" value, $2,170,269. The total value of all the zinc product was, therefore, $4,240,006.

Lead and zinc are mined and smelted in 206 "regular establishments," employing 7483 hands (7323 men and 160 boys), an increase of 336 per cent. since 1870. Reducing the reported values for 1870 to a gold standard, the increase in the value of products was about 210 per cent. The average yearly wages paid to miners in 1870 was (in gold) $280; in 1880 it was $353, an increase of 26 per cent. The great increase in the number of hands employed, and in the total value of profits, is to be explained, at least in respect to lead, by the increase in silver-mining, by which ores, otherwise useless, acquired a large value. The increase in the wages paid shows that the business is a profitable one. It must become more remunerative, for the use of both of these metals is constantly increasing.

Minor Minerals.—There are several minor minerals, some of which, as nickel, manganese, and tin, are also metals. The value of all of these, in 1880, was $3,387,444; of which nearly one-half was produced in New York. The two metals, Aluminium and Magnesium, exist abundantly, but they are as yet produced in limited quantities, and by expensive processes. Their possible value, hereafter, will be considered in a subsequent chapter.

In stating the values of all metallic products, the sums given include only the values of the mineral when extracted from the ground, and with such preparation as is necessary to fit it for transportation. When an industry is compound, embracing both mining and manufacturing — as when a furnace-company not only mines the ore, but also reduces it to pig-iron —that portion of the value given by the latter part of the process is not here included. The values of the *metallic products* of mines, in 1880, was 5.5 per cent. of the value of agricultural products, and 2.3 per cent. of the value of manufactured products, as follows:

Gold	$33,609,663
Silver	41,170,957
Iron	23,156,957
Copper	9,458,434
Lead	7,935,140
Zinc	4,240,006
Minor Metals	3,387,444
Total	$122,958,601

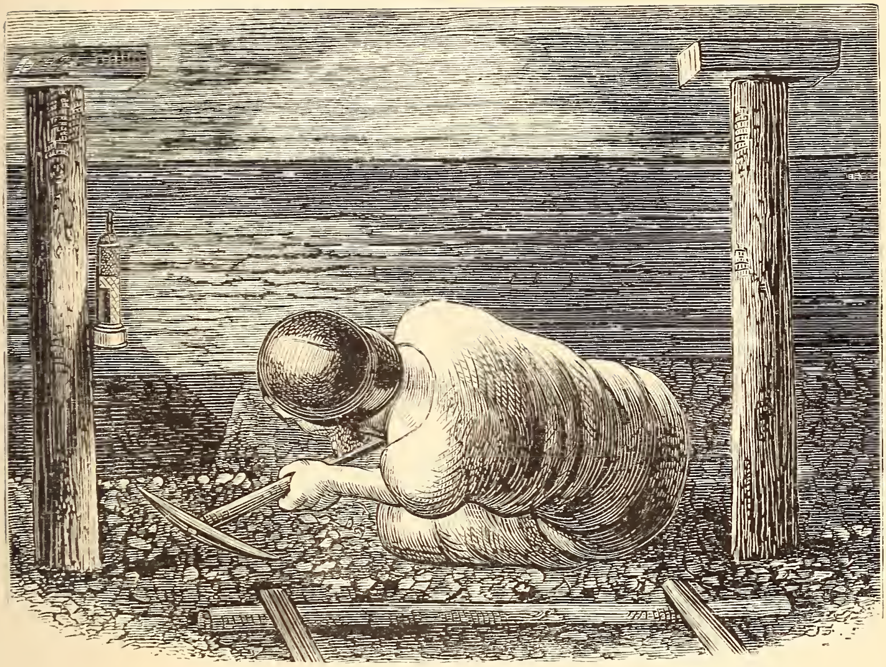
CHAPTER XVII.

COAL, ANTHRACITE AND BITUMINOUS.

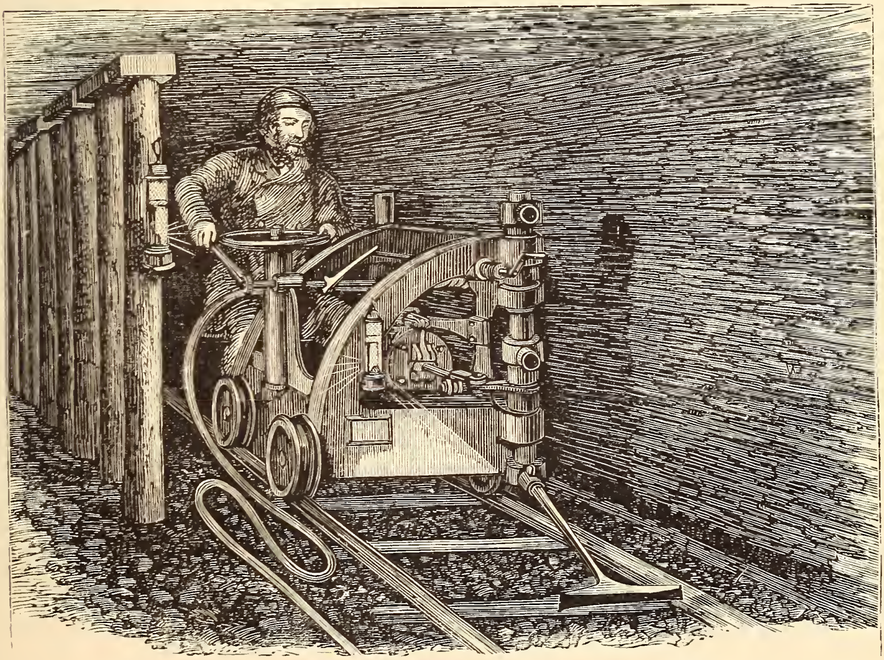
COAL is mined in twenty-five States of the Union. It is divided into two great classes, anthracite and bituminous coal. No perfect line of demarkation can, however, be drawn between these classes, for they shade into each other by almost insensible gradations, according to the greater or less percentage which they contain of volatile matter which has not been driven off by the intense heat to which the coal has been at some remote time subjected.

ANTHRACITE COAL.—It is convenient to consider as anthracite all that coal in which there is not more than 12 per cent. of volatile matter. This consists mainly of the Lehigh coal, which has from 3 to 10 per cent. of volatile matter, and the Scranton coal, which has from 9 to 12 per cent.; while the bituminous coal of western Pennsylvania has from 30 to 50 per cent. Intermediate between these extremes, but generally classed with the bituminous coals, are what are sometimes called "semi-bituminous coals," having from 17 to 25 per cent. of volatile matter. Anthracite coal is essentially the same as coke, formed artificially from bituminous coal; but the heat which expelled the greater portion of the bituminous matter was applied under a high pressure, so that the residue is more dense than that of coke, or even of bituminous coal.

The mining of anthracite coal is confined mainly to a portion of Pennsylvania, lying between the folds of the Alleghany Mountains, the coal basins having an area of not more than 500 square miles. In this region were mined, in 1880, more than 28,000,000 tons of anthracite; less than 10,000 tons being



MINER AT WORK—OLD MANNER OF WORKING.



NEW MANNER OF WORKING—COAL-CUTTING MACHINE.

(See Note 11.)

mined in Rhode Island and Virginia. The total production of anthracite in 1880 was 28,649,811 tons — being about 40 per cent. of all the coal mined in the United States; and its value was $42,186,678 — being about 47 per cent. of the total value of all the coal.

Bituminous Coal is much more widely diffused than anthracite, and is mined in twenty-four States of the Union. Pennsylvania furnishes not only nearly all of the anthracite, but also 43.4 per cent. of the bituminous coal of the United States. So that in this State was produced 67.7 per cent. of all the coal mined in the Union.

Table XV. shows for each State the quantity and value of the coal mined, in 1880, in the United States. Of that mined in Pennsylvania 28,649,812 tons were anthracite, and 18,075,548 tons were bituminous. All the coal of Rhode Island and a small part of that of Virginia is anthracite; all mined in the other States is bituminous. The table also shows the value of the minor minerals produced in each State.

TABLE XV.—COAL AND MINOR MINERALS.

States.	Coal.		Minor Minerals.	States.	Coal.		Minor Minerals.
	Tons.	*Dollars.*	*Dollars.*		*Tons.*	*Dollars.*	*Dollars.*
Alabama ..	322,934	475,559	....	N. J.	....	....	40,270
Arkansas ..	14,778	33,535	....	New York.	....	....	1,623,011
California .	236,950	663,013	19,448	N. C.	350	400	79,855
Colorado ..	462,747	1,041,350	....	Ohio	5,932,853	7,629,488	....
Georgia ...	154,644	281,605	120,135	Oregon ...	43,205	97,810	....
Illinois	6,089,514	8,739,755	102,324	Penn.	46,688,143	60,383,651	426,102
Indiana ...	1,449,496	2,143,093	22,291	R. I.	6,176	15,440	....
Iowa	1,442,333	2,473,155	....	S. C.	....	....	27,709
Kansas	763,597	1,498,168	....	Tennessee .	494,491	628,954	....
Kentucky .	935,857	1,123,046	....	Vermont ..	....	....	48,788
Maine	....	....	2,000	Virginia ...	43,120	100,637	179,125
Maryland .	2,227,844	2,584,455	159,303	Wash	145,015	389,046	....
Mass	....	....	101,970	W. Va	1,792,570	1,971,847	100,000
Michigan ..	100,800	224,500	41,075	Wyoming .	589,595	1,080,451	....
Missouri ..	543,590	1,037,100	13,196				
Montana ..	224	800	....	Total....	70,481,426	94,567,608	3,387,444
Nebraska ..	200	750	....	Irreg. Prod.	916,564	1,092,305	
N. H.	....	....	112,550				
	carry over.	*carry over.*	*carry over.*	Total Coal.	71,397,990	95,659,913	

Delaware produced minor minerals to the value of $163,310, and West Virginia to the value of $4500, which are included in the total.

The "regular" bituminous coal, 47,880,000 tons, value $52,463,000, was produced in 2990 establishments, in twenty-four States; the anthracite, 28,600,000 tons, value $42,196,000, in 277 establishments, nearly all of them in Pennsylvania. These 3267 establishments employed in all 170,864 hands (148,573 men and 22,291 boys), producing nearly 77,000,000 tons of coal, value about $94,600,000. The small number of establishments, compared with the amount and value of the product, furnishes better data for attaining precise statistics for coal-mining than are accessible in any other branch of industry.

The increase from 1870 to 1880 in the number of hands employed in coal-mining was about 82 per cent. (140.3 in bituminous and 33.2 per cent. in anthracite mining). The increase in the quantity of coal produced was about 105 per cent. (143.4 in bituminous coal, 82.7 in anthracite). But the increase in value was in a much less ratio. The average value of a ton of bituminous coal in 1870 was (in gold) $1.63; in 1880 it was $1.25—a decrease of 23.3 per cent. The value per ton of anthracite in 1870 was $1.97; in 1880 $1.47—a decrease of 25.3 per cent. The quantity produced per hand also increased very considerably. In 1870 the amount per hand, mined and raised to the surface, was 413 tons of bituminous coal, or 295 of anthracite; in 1880 it was 418 tons of bituminous coal, or 405 tons of anthracite—an average increase of about 16 per cent. per hand. This increase was, however, due mainly to the introduction of steam-engines, by which much of the work formerly done by men was now performed by machinery. Thus, while the quantity of coal mined was increased, from 1870 to 1880, about 105 per cent., its value was increased less than 30 per cent. The introduction of machinery, and other causes, required the investment of a much larger amount of capital in mining. In 1870 the capital necessary to produce a dollar's worth of coal was estimated at $1.33; in 1880, $3.67—an almost threefold increase.

The bearing of this upon the rates of wages is evident. In 1870 the value of the coal produced during the year by each miner was (in gold) $5.24; in 1880, each, with the aid of costly machinery, produced $5.60. In 1870 the miner received $1.05 per ton; in 1880 he received $0.78.5 per ton. In 1870 the wages paid to the miner were 59.8 per cent. of the value of the coal produced; in 1880 they were 53.9 per cent. In 1870 the average yearly wages of a coal-miner were (in gold) $346; in 1880 they were $321—a decrease of 7.2 per cent. But this diminution in the rate of wages did not enure wholly to the profit of the capitalists who owned or operated the mines. In 1870, the materials used in the business of mining amounted to 9.4 per cent. of the value of the product; in 1880 they amounted to 15.9 per cent.—an increase of 6.5 per cent. In 1880 the value of wages and material together was 69.8 per cent. of the value of the product; in 1870 they were 69.2 per cent. of this value. Thus in 1870 there was left 30.8 per cent. of the value of the product, over and above wages and the cost of material, for other expenses and profits; in 1880 there was 30.2 per cent. The percentage of surplus being substantially the same, the gross profits of the mining operators was increased in just the ratio of the increase in the value of the products — that is, about 30 per cent.; but the capital invested had been increased 185 per cent.; so that the average percentage of profit to the operator upon his capital invested was in 1880 only about one-third of what it had been in 1870.

Since 1880 the price of coal and the rate of wages has fluctuated; but the general tendency has been downward. The obvious inference is, that—as in the case of iron-mining — the production of coal is somewhat in excess of the demand, and there is no apparent prospect of any immediate increase of prices except in consequence of a decrease of production. And the rates of wages, as shown above, are among the lowest in any branch of American industry; while the labor is about the most severe and unpleasant of all.

CHAPTER XVIII.

PETROLEUM AND ITS PRODUCTS.

PETROLEUM ("rock-oil") under various names, such as naphtha, coal-oil, and the like, has been known in various parts of the world from the remotest antiquity. The petroleum springs of Rangoon, in what is now British Burmah, have, it is said, yielded for ages more than half a million of barrels a year. Its existence was known to the aborigines of this country; the peoples who preceded the existing races on this continent dug numerous wells in the petroleum region in order to collect the oil which flowed into them. Trees which have been found growing above these wells show that they could not be less than from 500 to 1000 years old. Early in the present century small quantities of the oil were collected and sold as a valuable medicine, under the name of "Seneca oil." Meanwhile it was discovered in Great Britain that oils (paraffine oils) of a similar character could be distilled from certain species of coal and lignite, and about 1850 the manufacture of these oils was introduced into the United States. In 1854 a company was formed for collecting the natural petroleum floating on pools and ditches in North-western Pennsylvania. In 1858 Mr. Drake, the manager of this company, conceived the idea that, by sinking a deep well, oil would be "struck." On August 28, 1859, a well had been bored down to a depth of 71 feet, when oil gushed to the surface at the rate of 400 gallons a day.

From the sinking of this well dates the beginning of petroleum mining, which has come to be a very prominent industry in the United States. Wells were immediately sunk in the rough region of North-western Pennsylvania, and the most un-

PETROLEUM PUMPING WELL NEAR OIL CITY.

(See Note 12.)

productive farm lands came to be held of the highest value; for a well, which could be sunk for a few hundred dollars, might yield, with scarcely any additional mining labor, hundreds of dollars a day.

Petroleum has this characteristic, that there is no apparent limit to the quantity that may be obtained by a comparatively trifling amount of labor. Practically, the value of it is regulated wholly by the amount wanted, and not by the quantity produced. The history of petroleum mining, therefore, furnishes an instructive lesson upon the relation between the value of a production, its supply in the market, and the demand for it.

The quantity produced in 1859 was 3,000 barrels, which sold at the wells for $13.00 per barrel. In 1860 there were 600,000 barrels, and the price fell to $6.72 per barrel; in 1861 the yield was 2,000,000 barrels, at $2.73. In 1862 the yield was 3,000,000 barrels, sold at $1.68; so that, although the quantity was 50 per cent. greater, the value was somewhat less. But a large foreign demand had been created, and in 1863 the price rose to $3.99 per barrel, and, although the quantity produced was 500,000 barrels less, the value was more than twice that of the previous year. The export demand increased so rapidly that it seemed that it would be unlimited; and in 1864 the price rose almost at a bound to $9.66 per barrel, and, although the product was less than it had been three years before, the value was almost quadrupled, exceeding $20,000,000. In 1865 the production rose from 2,100,000 to 3,500,000 barrels, and the price fell to $6.57 per barrel; still, the value of the product was $23,000,000. In 1866 the production was somewhat increased, but the price fell so that the value was $13,500,000. In 1867 the product was nearly the same, but it brought only $10,600,000, the price being $3.18. In 1868 and 1869 the product and price kept on increasing, and in 1870 there were 5,659,000 barrels, and, the price being $3.80 per barrel, the value was $25,208,550 ($20,166,840 in gold), a larger sum than was reached for several years afterwards. In 1874 the product reached to nearly 11,000,000 barrels, but the price fell to $1.18, so that the value was $12,760,000, and of this more than one-third was exported.

In 1880 the total amount of crude petroleum produced in the United States was 24,235,081 barrels, of which 23,915,446 were in North-western Pennsylvania, and 89,946 in other parts of the State; 219,254 in West Virginia and an adjacent county of Ohio; 5059 in other parts of Ohio; and 5376 in Kentucky. But for several years the production has been in excess of the demand, and large quantities were held over. These accumulations amounted, in June, 1879, to 7,948,352 barrels, and at the close of May 1, 1880, to 13,299,252 barrels. But the production was still continued in excess of the sales, so that at the close of the year there were 18,640,000 barrels in the hands of the producers. It is, therefore, impossible to form any accurate estimate of the actual value of the yield of that year. The quantity refined was 17,417,455 barrels (of 42 gallons each), and its value $16,340,581.

The cost of bringing the oil to the surface varies greatly in different districts. In the "flowing wells" of the great Bradford district, in Pennsylvania, it is only 6 or 8 cents a barrel; in the "pumping wells" of the lower country it is from 60 to 80 cents; and in the pumping wells of the Franklin district (which yield only about 7000 barrels of "heavy oil") the cost was $3 per barrel. The total number of wells drilled was 3696, of which 3086 were in the Bradford district, Pennsylvania; and, besides these, there were 137 "dry holes;" the estimated cost of sinking these wells being about $9,000,000. The number of hands employed, including skilled workmen, was 11,477, of whom 8784 were classed as "laborers." The average rate of wages paid in Pennsylvania was from $1.50 to $2.00 per day; in West Virginia, etc. (where, however, less than 500 hands were employed), the wages were from $1.00 to $1.50 per day; the total amount of wages in producing crude petroleum being about $7,500,000.

Nearly all of the crude petroleum yielded by the wells passes into the hands of the refiners, and, strictly speaking, the oil is not a merchantable product until it has been refined. A few of these refining establishments hold nearly all of the stock on hand, and so are able to regulate the supply thrown upon the market. In 1880 there were 86 of these establishments (mostly incorporated companies), having an invested capital of $27,395,746, the machinery and buildings being valued at $5,437,286. They employed 9869 hands, who received, as wages, $4,381,572, an average of $444 per year. The products of these refineries were:

TABLE XVI.—PETROLEUM AND ITS PRODUCTS.

Articles.	Quantity.	Value.
Illuminating oil	11,002,249 barrels.	$36,839,613
Naphtha	1,212,626 "	1,833,395
Gasoline	289,555 "	1,128,166
Reduced petroleum for journals	204,841 "	1,024,017
Paraffine wax	7,889,626 pounds.	631,944
Deodorized lubricating oils	70,415 barrels.	611,572
Paraffine oil	79,465 "	408,023
Reduced petroleum for cylinders	26,018 "	371,020
Residuum	229,133 "	297,529
Mineral sperm	16,544 "	202,275
Rhigoline	5,868 "	29,117
Petroleum ointment, harness oil, etc.	....	328,097
Total value of products	....	$43,705,218

The expenses of production were:

Materials.	Quantity.	Value.
Crude oil used	17,417,455 barrels.	$16,340,581
Coal, for fuel	684,664 tons.	1,027,905
Residuum, naphtha, and other fuel	.... "	291,103
Sulphuric acid	45,813 "	1,206,052
Caustic soda	772 "	85,064
Bone-black	1,990 "	62,815
Other chemicals	.... "	20,954
Barrels	9,717,306 "	11,618,607
Tin cans	23,841,089 "	2,793,997
Cases	6,452,801 "	906,911
Paint, glue, bungs, etc.	.... "	645,312
Value of raw material used	....	$34,999,101
Wages paid for refining	....	4,381,572
Total cost of refined petroleum	....	$39,380,673

The value of the refined oil and other petroleum products being $43,705,218, there is left $4,324,545—about 11 per cent.—for the apparent profits of refining; but the cost of the raw oil consists almost wholly in the labor expended in procuring it. The cost of the oil being $16,340,581, and the wages paid to the hands collecting it being, as before stated, about $7,500,000, there remains about $8,800,000 for profits upon the raw material; so that the actual profit upon the petroleum, when sold in the market, is not less than $13,000,000. It will be noted that the cost of the barrels, cans, and cases, in which the refined petroleum is packed, constitutes more than one-third of all the expense of the production.

The petroleum business is, in some respects, among the most important of our interests. The amount produced is limited only by the quantity demanded; and new uses for it are continually arising, so that the demand will probably increase. But, from the nature of the case, the business is, and will be, concentrated in few hands—the number being now fewer than it was in 1880. Most of the labor employed in the collecting and refining of petroleum is unskilled labor, and the wages earned by the hands are somewhat higher than those paid to other miners. Speculation, based upon the probable sales of petroleum, is very prevalent, and the reported values vary greatly from time to time.

CHAPTER XIX.

STONE-QUARRYING AND SALT-MAKING.

THE building-stones quarried in the United States belong to four classes of stone. Table XVII. shows, for the whole United States, the number of quarries of each kind, the capital invested, the amount quarried, the value of the product, and the number of hands employed:

TABLE XVII.—STONE-QUARRIES IN THE UNITED STATES.

Kinds of Rock.	Quarries.	Capital.	Product.	Value of Product.	Hands Employ'd.
	Number.	*Dollars.*	*Cubic feet.*	*Dollars.*	*Number.*
Marble and limestone	616	10,565,497	65,523,965	6,856,681	15,646
Sandstone	502	6,229,600	24,776,930	4,780,391	9,567
Crystalline silicious rocks...	313	5,291,250	20,506,568	5,188,998	11,477
Slate	94	3,328,150	4,572,670	1,529,985	3,033
Totals..................	1525	25,414,497	115,330,133	18,356,055	39,723

Of the laborers employed, 38,945 were above and 778 below the age of sixteen; 25,726 were employed in quarrying, 9840 in dressing the stone, and the remainder in hauling, etc. Table XVIII. gives for each State the value of each kind quarried, the number of quarries and of the hands employed in them, and the value of all the products.

It will be seen, by comparing this Table with other statistics, that in some of the States the quarrying of building-stones and dressing them for market forms an important branch of industry and a leading source of wealth. The value of the marble and slate from the 61 quarries in Vermont was more than one-third as much as that of all the grain crops raised upon her 35,000 farms. The granite from the 113 quarries of

TABLE XVIII.—QUARRY PRODUCTS, BY STATES.

States.	Marble.	Sandstone.	Crystalline.	Slate.	Quarries.	Hands.	Products.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Number.*	*Number.*	*Dollars.*
California	....	....	172,450	....	2	195	172,450
Colorado	....	9,000	41,400	....	6	134	50,400
Connecticut	....	680,200	407,225	....	38	1,902	1,087,425
Dakota	....	12,000	....	....	1	35	12,000
Delaware	....	....	12,600	....	3	30	12,600
Georgia	....	....	64,480	4,500	3	146	68,980
Illinois	1,320,742	21,830	....	....	43	2,315	1,342,572
Indiana	593,375	40,400	....	....	70	1,788	633,775
Iowa	666,554	4,200	....	....	131	2,091	670,754
Kansas	131,570	11,000	....	....	19	434	142,570
Kentucky	92,216	....	....	....	19	806	92,216
Maine	....	....	1,175,286	83,800	74	4,011	1,259,086
Maryland	65,929	....	224,000	56,700	17	701	346,629
Massachusetts	230,495	144,294	1,329,315	7,000	113	2,951	1,711,104
Michigan	26,085	59,080	....	....	9	200	79,165
Minnesota	201,593	41,150	13,075	....	41	1,175	255,818
Missouri	421,211	81,960	110,000	....	34	783	613,171
Nebraska	15,000	....	....	....	1	55	15,000
New Hampshire	....	....	303,066	....	39	595	303,066
New Jersey	....	400,420	99,000	15,000	25	812	514,420
New York	431,439	724,556	10,000	95,500	251	3,302	1,261,495
Ohio	669,723	1,871,924	....	....	245	4,902	2,541,647
Pennsylvania	240,934	627,943	211,454	863,877	164	4,284	1,944,208
Rhode Island	....	....	623,000	....	17	962	623,000
Tennessee	192,695	....	....	....	13	443	192,695
Vermont	1,340,050	....	59,675	352,608	61	2,762	1,752,383
Virginia	27,750	....	331,928	51,000	14	919	410,678
Wash. Ter	....	2,000	1,044	....	2	16	3,044
West Virginia	....	16,689	....	....	10	154	16,689
Wisconsin	189,320	37,745	....	....	60	820	227,065
Totals	6,856,681	4,780,391	5,188,998	1,529,985	1,525	39,723	18,356,055

Massachusetts was worth almost as much as all her corn and oats and rye; that of the 74 quarries of Maine more than any one of her grain crops, and two-thirds as much as her potatoes. There are few acres of land worth as much as the same area of a good quarry of building-stone, so situated as to be accessible to any great market. Stone and brick must become more and more the building material of the country, as the rapid diminution of the forests renders timber more and more costly. In none of our cities and larger towns is wood even now used to any great extent in building, except for interiors.

Salt is strictly a mineral product, and in some parts of the world is a product of the quarry. But almost the entire amount produced in the United States is made by evaporating the brine of subterranean springs by means of artificial heat. There are 276 salt-works in sixteen of the States, having a capital of

$8,550,000; and producing, in 1880, 30,850,000 bushels, nearly three-fourths of which was made in Michigan and New York. There were employed 4473 hands, who received, as wages, $1,305,000, an average of $292 per year. The value of all the materials used was $2,350,000—wood and coal for fuel making nearly half the amount. The value of the salt produced was $5,180,000.

Summary of Mining Values.

Table XIX. shows the value of the mining products of the United States in 1880, and the number of miners employed. The Census Report does not give the number of gold and silver miners. We have endeavored to supply these by deducting the number of those given for the other metals and coal (220,475) from the total number returned as "miners" (234,228), leaving 13,753 for gold and silver miners. We treat petroleum, building-stones, and salt as properly belonging to mining, and therefore give the number of "hands" employed in their production. The quantity of petroleum given is that of the crude oil refined (not that of the total yield of the wells which might have been refined); the value is that of the refined oil and other products, as already explained.

TABLE XIX.—QUANTITY AND VALUES OF MINING PRODUCTS.

Articles.	Quantity.	Value.	Miners, etc.
Gold	1,614,742 ounces.	33,609,663 dollars.	13,753
Silver	31,797,474 "	41,110,957 "	
Iron ore	7,974,706 tons.	23,156,957 "	31,668
Copper	54,172,017 pounds.	9,458,434 "	6,258
Lead	162,938,105 "	7,935,140 "	7,483
Zinc	62,681,459 "	4,240,006 "	
Minor minerals	....	3,387,444 "	4,202
Coal	71,426,436 tons.	95,716,851 "	170,864
Petroleum	17,417,455 barrels.	43,705,218 "	21,346
Stone, quarried	115,380,133 cubic feet	18,356,055 "	39,723
Salt	30,850,000 bushels.	5,180,000 "	4,473
Totals		285,856,725 dollars.	299,770

CHAPTER XX.

FISHERIES AND FISH-CULTURE.

UP to 1880, the Census Reports in relation to the fisheries of the United States were so meagre as to be not only useless, but in many respects misleading, and so worse than useless. The Census of 1870 reported the value of all the fishery products of that year as only $11,000,000. "It is questionable," says the Superintendent of the Census, "whether the results obtained ever reached 20 per cent.—if, indeed, they ever reached 15 per cent.—of the actual facts." But for the Census of 1880 preparations for more thorough work were set on foot, under the immediate direction of Prof. Baird, Secretary of the Smithsonian Institute, and President of the United States Fish Commission; and a comprehensive investigation was undertaken into the statistics of the fisheries and fishing population of the United States.

"Special canvassers, well trained for such inquiries," says the Superintendent of the Census, "were engaged to proceed in boats along the entire eastern and southern coast from Maine to Texas, visiting every fishing port or fishing village, and collecting the whole body of social and industrial statistics of the population engaged in this occupation. . . . Other parties were engaged to canvass the Pacific Coast, the northern lakes, and the western rivers, while special agents were employed to work up the oyster fishery, and to obtain statistics of the fish-markets of the principal ports."

The result is, that we have now the means of investigating the fishing industry of the country perhaps more ample than for any of its other industries. In general, it may be stated that it employs 131,426 persons, of whom 101,684 are "fishermen," and 29,742 are "shoresmen." The total capital invested is

LIGHT OF THE PYROSOMA.

See Note 13.

$37,955,349. This capital comprises 6605 "vessels," with a tonnage of 208,298 tons—value, $9,357,282; and 44,804 boats—value, $2,465,393; the minor apparatus and outfits were valued at $8,145,261; the remainder of the capital ($17,987,413) includes all the shore property. The value of all the products of the fisheries in 1880 was $43,046,953.

It is not possible to state even approximately how large a proportion of the value of the products of the fisheries are practically paid out in the form of wages, since to a very great extent the fishermen are the owners of the boats, and carry on the business upon their own account; and in most cases of deep-sea fishing, the fishermen receive as pay a certain fixed proportion of the catch, another portion going to the owner of the boats, who also furnishes the outfit. But, dividing the entire products by the number of all persons—fishermen and shoresmen—engaged in the fisheries, we find that the average for the year was $327.50 for each person. It must be borne in mind, also, that to a very considerable extent the fishermen are employed as such for only a part of the year, many of them pursuing some other occupation during the remaining months. It would, therefore, seem that the fishing business ranks high among profitable industries.

It has been found convenient to divide the fisheries into several departments. The oyster, whale, and seal fisheries need no explanation. The menhaden fishery is carried on mainly along the shores of Long Island, New York, and in the adjacent waters. These fish are not used as food to any great extent, although within a few years they have begun to be put up in the same manner as sardines. They are, however, caught mainly for the oil which they furnish abundantly, and for manure, for which they are very valuable. In the division of "general fisheries," which furnish fully one-half of the entire product, are comprised the cod, the mackerel, the shad, the salmon, and all fresh-water fisheries, including those of the great lakes.

Table XX. shows for each State the number of persons engaged in fisheries, the amount of capital invested, and the total value of the products; and also separates the value of the products of the oyster, whale, menhaden, and seal fisheries.

TABLE XX.—FISHERIES AND PRODUCTS, BY STATES: 1879.

States.	Grand Totals.			Products of the Several Fisheries.				
	Persons Empl'd.	Capital Invested.	Value of Products.	General Fisheries.	Oyster Fishery.	Whale Fishery.	Menhaden Fishery.	Seal Fishery.
	Number.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
Alabama..	635	38,200	119,275	74,325	44,950	....	....	....
Alaska....	6,130	447,000	2,661,640	564,640	....	500	....	2,096,500
California*	3,094	1,139,675	1,860,714	1,341,314	....	201,650	....	15,750
Conn.....	3,131	1,421,020	1,456,866	383,887	672,875	32,048	256,205	111,851
Delaware..	1,979	268,231	997,695	309,029	687,725	....	941	....
Florida*...	2,480	406,117	643,227	426,527	15,950	....	....	....
Georgia...	899	78,770	119,993	84,993	35,000	....	....	....
Illinois....	300	83,400	60,100	60,100	....	....	....	....
Indiana...	52	29,360	32,740	32,740	....	....	....	....
Louisiana..	1,597	93,621	392,610	192,610	200,000	....	....	....
Maine.....	11,071	3,375,994	3,614,178	3,576,678	37,500	....	....	....
Maryland..	26,008	6,342,443	5,221,715	479,388	4,730,476	....	11,851	....
Mass.*....	20,117	14,334,450	8,141,750	5,581,204	405,550	2,089,337	61,769	....
Michigan..	1,781	442,645	716,170	716,170	....	....	....	....
Minnesota.	35	10,160	5,200	5,200	....	....	....	....
Mississippi.	186	8,800	22,540	12,540	10,000	....	....	....
N. H......	414	209,465	176,684	170,634	6,050	....	....	....
N. J......	6,220	1,492,202	3,176,589	949,678	2,080,625	....	146,286	....
New York.	7,266	2,629,585	4,380,565	1,689,357	1,577,050	....	1,114,158	....
N. C......	5,274	506,561	845,695	785,287	60,000	408	....	....
Ohio......	1,046	473,800	518,420	518,420	....	....	....	....
Oregon....	6,835	1,131,350	2,781,024	2,776,724	....	....	....	4,300
Penn......	552	119,810	320,050	132,550	187,500	....	....	....
R. I.......	2,310	596,678	880,915	302,242	356,925	....	221,748	....
S. C.......	1,005	66,275	212,482	192,482	20,000	....	....	....
Texas.....	601	42,400	128,300	81,000	47,300	....	....	....
Virginia...	18,864	1,914,119	3,124,444	602,239	2,218,376	....	303,829	....
Wash. Ter.	744	30,358	181,372	109,960	10,000	....	....	61,412
Wis.......	800	222,840	253,100	253,100	....	....	....	....
Totals..	131,426	37,955,349	43,046,053	22,405,018	13,403,852	2,323,943	2,116,787	2,289,813

It has also been found convenient to group the fisheries into six sectional divisions: Division I. comprises the six New England States. Here mostly are carried on the cod, mackerel, and whale fisheries; the value of the entire products of this division being about 33.3 per cent. of the whole. Division II. comprises the Middle States, exclusive of the fisheries of the great lakes. Here are carried on most of the menhaden, about one-third of the oyster, and one-eighth of the general fisheries; the value of the products of this division being about 20 per cent. of the whole. Division III. comprises the Southern Atlantic States. Here are carried on more than one-half of the oyster, and about

* In Florida there are also sponge-fisheries producing $200,750, in California $302,000, and in Massachusetts $3,890, products of "marine salt industry," which are included in the total of products for those States.

one-tenth of the general fisheries; the value of the products of this division being about 22.3 per cent. of the whole. Division IV. comprises the Gulf States. The fishing industry here is comparatively small, the value of its products being about 3 per cent. of the whole. Division V. comprises the Pacific States and Territories. The seal-fishery is almost wholly carried on here, and the general fisheries, especially that of salmon, are very extensive; the value of the products of this division form about 17.4 per cent. of the whole. Division VI. comprises the Great Lakes. The products of this division are included among the general fisheries, and form about 4.1 per cent. of the whole.

TABLE XXI.—FISHERIES AND PRODUCTS, BY DIVISIONS: 1879.

Divisions.	Grand Totals.			Productions of the Several Fisheries.				
	Persons Empl'd.	Capital Invested.	Value of Products.	General Fisheries.	Oyster Fishery.	Whale Fishery.	Menhaden Fishery.	Seal Fishery.
	Number.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
I......	37,043	19,937,607	14,270,393	10,014,645	1,478,900	2,121,385	539,722	111,851
II......	14,981	4,426,078	8,676,579	2,882,294	4,532,900	....	1,261,385	....
III......	52,418	8,951,722	9,602,737	2,217,797	7,068,852	408	315,680	....
IV......	5,131	545,584	1,227,544	713,594	313,200	....	....	....
V......	16,803	2,748,383	7,484,750	4,792,638	10,000	202,150	....	2,177,962
VI......	5,050	1,345,975	1,784,050	1,784,050	....	....	....	....
Totals.	131,426	37,955,349	43,046,053	22,405,018	13,403,852	2,323,943	2,116,787	2,289,813

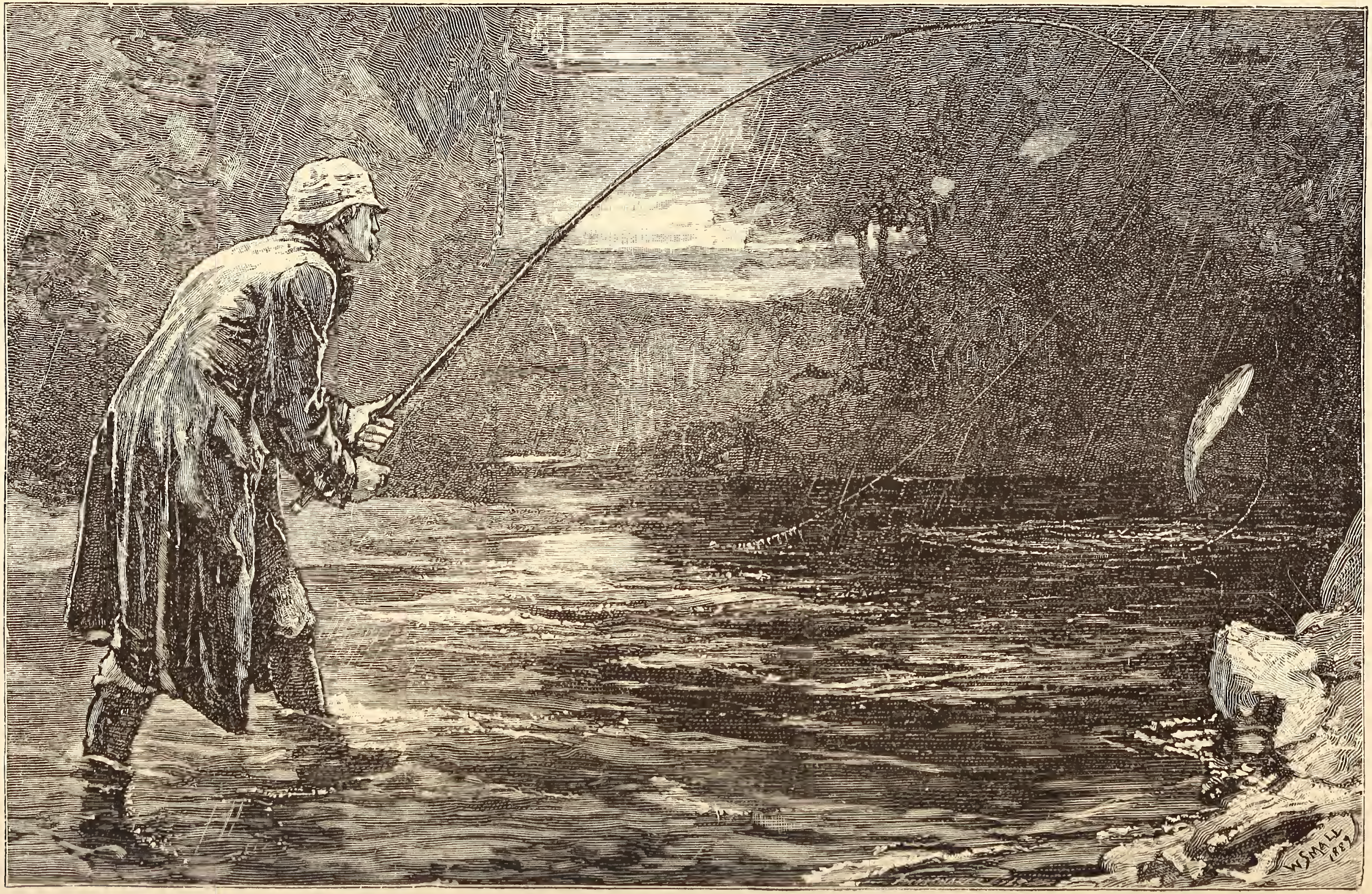
Each of the different branches of the fishing industry furnishes matter worthy of consideration in respect of the likelihood of its being one in which a person can profitably engage.

The Whale-Fishery.—This has shrunk within limits far narrower than that which it formerly occupied. Not many years ago whale-fishing was extensively carried on from all ports in New England, and from some in New York, especially that of Sag Harbor in Long Island. Now, of the $2,323,000 products of the whale-fishery, $2,089,000 were earned in the State of Massachusetts; and of this, $1,897,000 were earned by vessels from New Bedford, which is now practically the only whaling-port of the United States. The New Bedford products were 1,135,000 gallons of sperm-oil, value $1,060,000; 595,000 gallons of whale-oil, value $257,000; 243,000 pounds of whalebone, value \$567,000; 18,000 pounds of ivory, value \$5000; $62\frac{1}{4}$ pounds of ambergris, value \$6,225.

THE SEAL-FISHERY.—The seal-fishery of the United States is confined mostly to the procuring of the skins for furs, the value of the flesh and oil being of secondary importance; whereas, in the Greenland seal-fishery, carried on mainly in Nova Scotia and Newfoundland, the main product is the oil. Our seal-fishery is mainly conducted in Alaska, where, in 1880, there were secured 147,450 seal-skins, valued at \$1,474,500, or \$10 apiece, a large decrease from 1879; and 3500 sea-otter skins, valued at \$175,000, or \$50 apiece. There is every reason to believe that, unless prompt legislation is had to prevent the killing of seals in the breeding-season, it will not be very long before the animals will become commercially extinct.

THE SALMON-FISHERY.—Salmon were formerly abundant in all the rivers of the Atlantic side, northward of the Potomac. They are now practically unknown there. All the salmon caught in Maine in 1850 were valued at only \$21,000; in Massachusetts there were caught 220 pounds of salmon, valued at \$33; it does not appear that a single salmon was caught elsewhere upon the Atlantic side of the United States. Measures have been taken to re-stock these rivers with salmon, of which more will be said hereafter. But at present salmon-fishing belongs wholly to the Pacific side, and mainly to Oregon and the Sacramento River, in California, where it employed about 8000 persons. The total catch of Oregon in 1880 was 39,500,000 pounds; value, as fresh fish, \$2,776,724. But a very large part of the salmon were canned, and in that state sent to market. In Oregon and California there were some 45 canning establishments, employing about 8000 hands, and putting up 31,453,000 pounds of salmon in 1-lb. cans, the value of which was \$3,255,365. The cost of the fish canned was \$909,818; so that there was an increased value of \$2,345,547 given to the fish by the process of canning. These figures evince, beyond possibility of doubt, that salmon-fishing in Oregon and the adjacent region is an exceedingly profitable industry.

THE COD-FISHERY belongs almost wholly to Massachusetts



SALMON-FISHING.

See Note 14.

and Maine, the catch from those two States in 1880 being about 228,000,000 pounds. A portion of this, valued at $450,000, was consumed fresh; but the greater part was dried and salted for market. From 215,000,000 pounds of fresh codfish, 80,000,000 pounds of dried fish were prepared, valued at about $2,750,000—making the total products of the cod-fishery about $3,200,000. The fishing for hake, halibut, and haddock is essentially like that of cod. The value of all these fish was about $1,800,000, bringing the value of this class of fisheries up to at least $5,000,000 in Massachusetts and Maine.

The Mackerel-Fishery also belongs to Massachusetts and Maine. The catch in 1880 was about 90,000,000; the value of the product, fresh and pickled, about $1,700,000.

The Herring-Fishery belongs chiefly to Maine, although it is carried on to some extent in Massachusetts. The entire value of its products in these two States was, in 1880, about $1,200,000. Of this, nearly 2,400,000 pounds, valued at $800,000, were put up in Maine as sardines. This sardine industry is a new one, which, it seems certain, must receive a very rapid growth and development. The products already compare favorably with those of France. Until quite recently these American sardines were put up with French labels, and sold in the market as an imported article. The oil used in preparing them is that produced from cotton-seed—which is also used in France instead of olive-oil, large quantities being exported from the United States for that purpose.

It is not to be expected that the deep-sea fisheries of the New England States will in the future show any marked increase; most likely, indeed, they will show a decline when compared with the increase of the population of the country; for the reason that the salt fish, which is their principal product, forms a less considerable part of our diet than it formerly did; whereas, fresh fish, caught near the shore or in our inland waters, becomes of more and more easy access.

The Oyster-Fishery is by far the most important of any in the United States. The value of its products is more than four times that of any other kind of fish. Oysters are found near the shores of almost all seas, never very far from the shore, and usually in from two to six fathoms of water. Their favorite habitation is the tranquil waters of the bays formed at the mouths of great rivers. Long Island Sound and Delaware and Chesapeake bays are specially adapted to their nature and habits. Of the $13,400,000 products of the oyster-fishery, none, of course, come from inland waters, only $300,000 from the shores of the Gulf States, and not more than $10,000 from the Pacific coast. The area suitable for the oyster is therefore very limited; and there is every reason to apprehend, unless prompt legislative action is taken to insure their cultivation and to regulate their capture, that the oyster-fishery will before very long become greatly diminished.

That such danger exists, and that it may be warded off, we learn by European experience. In Great Britain the oyster-beds are kept up by careful culture, and by the introduction of fresh "seed" from all quarters. Some forty years ago it was found that the oyster-beds of France were nearly exhausted. About 1858 Government set on foot measures for their restoration by establishing "oyster-packs" in the sheltered bays of St. Brieuc and Arcachon; and these were rapidly extended all along the Atlantic and Mediterranean coasts, wherever a favorable locality was found. The result has been that the oyster-product of France is now far greater than ever before. The matter is one which cannot be too strongly urged upon the consideration of the State government, and upon that of individuals; and there can be but few departments of industry which promise so large and certain profits.

While these sheets were passing through the press it was announced that Prof. Ryder, of the United States Fishery Commission, had discovered a method for the artificial propagation of the oyster. He had ascertained that the American oyster is oviparous; that is, that the young were hatched from eggs, and that there are male and female oysters. The eggs of the female and the melt of the male are procured by making incisions in the "mantle," and are artificially mixed together, just as with those of other fish. The eggs are very small, requiring, it is estimated, 200,000,000 to fill a gill measure. In from four to twenty-four hours after the impregnation of the egg, the young fry assume the swimming condition, but soon fix themselves to some object, and the deposition of the shell begins; they grow so rapidly that after forty-six days the shells are from one-fourth to three-fourths of an inch in diameter. If all that is expected should be realized in this discovery, it will be perfectly practicable to establish beds of artificially hatched oysters in all our shallow, brackish waters. That is, oysters can be produced at will, and be reared and fattened wherever the water is of proper saltness. What has heretofore been an uncertainty in oystering, will become as certain as the rearing of any other fish or animal.

Fish-Cultivation.—The art of rearing fish and fattening them in ponds has been practised from very ancient times, and especially by the Chinese. But the science of fish-breeding, or their propagation by means of the artificial impregnation of the eggs, is hardly forty years old, although there is evidence that it was suggested in Europe as early as 1758. Nothing practical was undertaken, upon any considerable scale, until 1849, when Prof. Coste, of the College of France, put forth a book upon the subject, which gave rise to the present industry of fish-culture, which has already accomplished much, and which can hardly fail to accomplish much more in the near future. The whole science rests upon two great facts: Fish are prolific to an extent vastly greater than any other creatures used for human food; and the waters of rivers, lakes, and oceans furnish spontaneously food for any conceivable number. Add to this that several of the most important species are migratory — setting out when young in the pursuit of food for unknown distances, and returning at stated periods to the rivers and shores for the purpose of spawning, and so coming within reach of easy capture.

About 1860 several persons in various parts of the United States took up fish-culture as an occupation, not as a mere pastime or matter of scientific research. The result of their efforts was so promising that in 1871 the National Government appointed a United States Fishery Commission, at the head of which was Prof. Baird, whose duty it was to prosecute investigations in order to ascertain what diminution had taken place in the number of food-fish upon our coasts and in our rivers and lakes, and to devise measures to remedy the evil. The efforts of this Commission were first directed towards the re-stocking of the several waters, to the erection of fish-ways around falls and dams, and to procuring the enactment of State laws forbidding the taking of fish during the spawning season, and regulating the use of seines, nets, and other wholesale means of capture. In time the attention of the Commission was also directed to the introduction from other countries of valuable species of fish not natives of the United States, but which there was reason to believe could be naturalized.

Although much has already been accomplished in the matter, there is good reason to believe that the limits of possible acclimatization have not yet been reached; that, for example, salmon and shad may be raised and perpetuated in fresh-water lakes, without their ever making their way to the ocean. With respect to the salmon, at least, this is highly probable; for there are numerous species closely akin to the sea-salmon which have their homes in all our great lakes. With respect to the shad, there is still room for doubt. But even if salt-water fish, or those migratory species who live mainly in salt-water, and only come at stated seasons to fresh-water, shall still retain their present habits, it is very certain that the raising of other fish in all our lakes, ponds, and clear rivers may be carried on quite as profitably as the breeding and raising of live-stock can be upon our farms. The industry is yet so new among us that precise statistics are not attainable; but there is enough to warrant the assertion of those best qualified to form an opinion, that an acre of fish-pond can be made to yield as much net profit to its owner as an acre of pasture, corn-field, or garden.

If, therefore, a man have upon his own farm a natural fish-pond, or if he can make an artificial one by damming up a brook, he cannot do better than devote it to fish-culture, just as he would devote so much land to agriculture or stock-raising. If a considerable stream or pond is bounded by the lands of several proprietors, they should agree among themselves as to the modes of catching the fish, which must, from the nature of the case, be the common property of all. In regard to the great lakes and waters along the coast, which, and all contained in them, belong to the public domain, the exercise of the right of fishery should be regulated by general laws—national or state—according as to whether these waters pertain to some particular State, or to the collective United States. For example, the present destructive manner of catching the menhaden should be so far restricted that enough shall still be left to keep up their numbers. Shad-nets should be permitted only at the proper season, and with proper nets; salmon should be allowed free access to and from their spawning-grounds. The oyster-beds should be most sedulously protected, so that no one now existing shall be exhausted, and new ones should be established wherever there is a suitable spot. Much has—thanks to the Fishing Commission and other organizations—been effected in this direction, but more remains to be done.

The "migratory" fish, especially the salmon and shad, deserve especial attention, for the whole broad ocean is their feeding-ground. All that is needed to fully stock these watery pasture-fields is to see to it that enough of the parent fish be enabled to reach their spawning-grounds, and that the young fry be enabled in due time to make their exit to the ocean. Once there, they will take care of themselves. When it is borne in mind that each female shad has at least 25,000 (sometimes, it is said, 150,000) eggs, and each salmon quite as many, and that each one of these may become a fish, it will be apparent that there need be little trouble in stocking the waters to their practically unbounded feeding capacity. How easily this may be done, is shown by the fact that eight or ten millions of young shad are annually turned loose in the Hudson River from a single shad-hatching establishment near Albany; and the like, to a more limited extent, is done for the Connecticut River, and also for rivers farther South. The result is evinced by the fact that the shad-fishery in those streams, which had begun to fall away, has already regained most of its ancient productiveness. The shad-fishery lasts only a few weeks in the year, but its value in the Middle and South Atlantic States was fully $1,000,000 to the fishermen employed in the business.

But even more than with these salt-water fish does pisciculture commend itself to attention in our fresh-water lakes, ponds, and rivers. That nearly all of these, including Lakes Champlain and Ontario, had been pretty nearly "fished-out," is well known. But, to some extent, these have been tolerably re-stocked. The fisheries of Erie and Michigan produced, in 1880, more than $1,000,000, and there is every reason to anticipate a continually increasing product, as fishermen grow wiser in their methods, and learn how to perpetuate, as well as how to capture, the inhabitants of the waters.

It admits of no question that the fishing industry of the United States must become a far more important element than it has ever been in national and individual wealth. The product can be increased to any extent, with little labor except the mere catching of the fish. Once hatched, they grow and fatten without asking man to feed or shelter them. The vast life-supporting powers of our waters have hardly begun to be appropriated by man to his uses. Our fisheries are as yet hardly more developed than agriculture was before man began to plough and plant, and contented himself with merely reaping the chance-sown growths of the untilled soil. The ocean, moreover, unlike the land, has not been, and never can be, portioned out among individual owners. Any man can, without any pre-emption law, enter upon any piece of water not actually occupied by another, and appropriate all that he finds there. And if it so be that any one has come to be the possessor of a piece of inland water, he needs, so to speak, only to sow it with fish-seed in order to gather such an increase of harvest as few other parts of his possessions will yield.

The various industries immediately connected with fisheries —such as the canning of fish and shell-fish—are rapidly growing into importance. Men have found them profitable, and, therefore, others will find them profitable. The increased value of salmon by canning in Oregon and California is noted on page 228.

On the Passamaquoddy River, in Maine, herring worth, when fresh, not more than $50,000, were put up as "sardines" in about 2,400,000 boxes holding one pound each, and their value in this condition was $770,000. The statistics of the values of canned lobsters show similar results. The ways to wealth opened in the fishing industry are, therefore, exceedingly numerous.

CHAPTER XXI.

FORESTS AND THEIR PRESERVATION.

WHEN the first white emigrants came to the Continent of North America, they found the whole region densely wooded. To cut down the forests was the first essential to settlement. The axe of the woodman was too slow an implement for the purpose, and fire was employed. In an almost incredibly short period of time all the settled parts of the Atlantic coast, from Maine to Georgia, were bared of trees; and before many years had passed the ruinous effects of this devastation began to show themselves. They are increasing year by year, and the end is not yet. Two generations of wise effort will not undo the mischief caused by the folly of a season; if, indeed, it can ever be wholly undone. The old Greeks had a word which literally meant "to cut down the trees," but was applied to the utter laying waste of a country. We are beginning to find out, and unless well-considered remedial measures are promptly supplied, those who come after us will still more sorely find out, that our tree-choppers are the workers of ruin to agriculture and consequently to every other interest of the country.

The first great evil of the indiscriminate deforesting of a country is that it entails a scarcity of water; and water is the prime essential of fertility. The hidden fountains of all our rivers and wells are in the atmosphere. Every drop of fresh-water upon the earth is supplied, in the form of rain or dew, from this inexhaustible reservoir. Trees act in several ways in regulating the supply of water. In some cases they certainly have an important share in actually producing the phenomenon of rain. Thus, in the island of St. Helena great attention has

AVENUE OF HEMLOCKS AND SPRUCES.

See Note 15.

for the last fifty years been given to clothing the steep hill-sides with forests, and it is well settled that the quantity of absolute rainfall upon the island is twice what it was when Napoleon was immured in his ocean-barred dungeon. The reason is obvious. Trees in a hot climate always have a temperature lower than that of the surrounding atmosphere. The heated air, loaded with invisible moisture which it has sucked up while passing over the surface of the ocean, comes in contact with these cooler trees and is forced to give up a portion of its moisture, which is condensed in the form of rain or dew. It is a repetition, upon a larger scale, of what occurs when a vessel of iced water is brought into a heated room.

Even when trees cannot be shown to exert any positive influence in increasing the absolute rainfall, they act most potently in the more important matter of regulating its distribution, equalizing it from one season to another. They shelter the ground beneath them, and thus prevent the rain which falls from rapid evaporation, and allow it to sink into the soil, keeping the springs and fountains in perpetual flow, even in times when the windows of heaven are shut for a season. Their roots penetrate deep into the earth, and prevent it from being washed away by any sudden shower, and form a kind of sponge which absorbs the moisture, giving it out slowly and uniformly, thus equalizing the flow, and preventing droughts, on the one hand, and floods on the other. But when the forests on the hill-slopes are cut down, the rain slides down them as upon a roof, and every shower swells the brooks to torrents. Every rivulet pours its accumulations into the rivers, whose channels are insufficient to carry off the sudden accession. Hence come sudden inundations, followed almost immediately by low water; for the rainfall, whose flow should have been distributed over weeks, is drained off in as many hours. The water which should have bubbled up in springs, and flowed in perennial brooks, making the meadows green, is carried at once through the great rivers to the ocean, to be again taken up by evaporation, only to go again through the same changeless round. The volume of the great rivers may undergo no apparent change for centuries, especially when they derive their water from a wide extent of country, for droughts in one section are balanced by showers in another. But the smaller rivers diminish, the rivulets dry up, except immediately after rains, when they are greatly swollen. Thus, by the constant operation of one law, the destruction of the forests causes the two opposite evils of droughts and floods.

There is still another phase of this process of devastation. The trees and their roots form a support to the hill-side soil. This removed, the soil is washed away by each recurring shower, and in no very long time what had been a fertile slope becomes a mound of hard clay or a heap of naked rocks, upon which not a blade of grass can find root.

Not a few of the regions which were once the seats of civilization are now the standing monuments of man's folly or wickedness in baring them of their ancient forests. Palestine was once a land of brooks and fountains, of wooded heights and well-watered fields; now, except the Jordan, there is hardly a valley which is not a "wady" or dry watercourse, save in the rainy season. Says Baden-Powell: "In the high lands of certain districts, now barren and almost uninhabited, are found traces of ancient cultivation. What were once evidently river-beds are now dry, and there are ruins of numerous villages. The river-beds are dry, except when at the rains they are swollen into sudden torrents."

The African shores of the Mediterranean, extending far into what are now the deserts of Barca and of the Sahara, were, at the beginning of our era, and for centuries before and after, the granary of the Roman Republic and Empire. Long lines of aqueducts now stretch their arches over the burning sands, once bringing abundance of water to towns and cities in a region where even the camel can scarcely find water to last him from one fountain to another.

So it is in many parts of India, not only in lower Bengal, but in the far-off Punjaub, "where the half dried-up streams, coming from the now denuded lower hills, point to the inevitable conclusion that the forest denudation has deprived them of their ancient water supply, and has ruined the rainless countries which were once dependent upon them." Among the hills of Ceylon, where the forests have been cut down in order to form extensive coffee plantations, the loss of the springs and fountains has already grown to be an evil of great magnitude; and there are wide districts which have within our own day been abandoned from this cause.

In a large portion of Greece the forests that once clothed every hill-side have long disappeared, and as a consequence the most famous fountains of antiquity now flow only in song. Rivers of ancient renown have shrunk to rivulets which a child may ford. The Lernæan Lake is a stagnant pool, so hidden by reeds and rushes that the traveller passes by it without noticing it, unless some one points out its site to him. Parts of Spain and France have the same story to tell. Italy has suffered less, for her lofty mountains are less accessible to the woodman's axe, and are yet the parents of perpetual streams; but she has not escaped. The famous Rubicon has dwindled to a brook so insignificant that antiquaries are not able with certainty to decide which of several is the right one.

In tropical and semi-tropical regions the immediate connection between forests and the water supply is most apparent. When the Spice Islands, some two centuries ago, fell into the hands of the Dutch, they were covered with a dense growth of spice-bearing trees. The new possessors thought it best to increase the value of the spices by limiting the supply; so most of the trees were cut down, and the islands, once densely peopled, were transformed into piles of bare volcanic rocks. At Penang the Chinese emigrants pursued the same short-sighted course which so many of the settlers in our western settlements have partially adopted. It was their custom to raise but a single crop from the virgin soil. They cut down the trees and burned them, thus getting for the year's crop an abundant supply of potash and other elements, and then repeated the process the next year upon a new patch. As their cultivation moved farther into the island, it left an ever-widening desert behind it; and the island would by this time have become uninhabitable had not the British Government, when it took possession of this portion of India, interposed in time to prevent the practice.

But one need not go to the Old World to find warning examples, though as yet the evil has not with us risen to such a point as to be irremediable; but it has for years been growing in magnitude, and no one problem in economics is at this moment more forcibly impressing itself upon thinking men than this of putting bounds to the destruction of our forests, and restoring them, in a measure at least, where they have been wantonly destroyed. A quarter of a century ago, one whose thoughts had been turned in this direction wrote:*

"Our own country is yet too new, and our forests are yet too numerous and extensive, for scarcity of water to have become a serious evil. But like causes produce like effects; and, unless we change our procedure, our children will suffer from our wanton carelessness. We have no right, for our own temporary gain, to desolate the land. No generation has more than a life-interest in the earth, of which it is but a trustee for future generations. Every man who revisits his early home in one of the older States, after an absence of a few years, cannot fail to notice the diminution of the streams and springs. There is probably no constant water in the brook that turned his toy water-wheel. The springs in the pasture, which he remembers as ever-flowing, are dried up; and if it be a season of unusual drought the cattle must be driven long distances to water—a necessity that was never known in his boyhood. More especially will this be the case if a furnace or neighboring railroad has occasioned a rapid demand for fuel. The trees have gone, and with them the water; and the meadows are dry and parched. In their haste to be rich, the farmers have killed the goose that laid the golden eggs for them.

"Within a mile or two from my father's homestead were some half-dozen beautiful ponds lying among the woods. One of these, known as 'Spring Pond,' was a perfect gem. It lay in a deep hollow, whose steeply sloping sides were clothed with a magnificent growth of maple, beech, and birch. At the foot of a sandy bluff the clear, sparkling water welled up, as if from the orifice of a subterranean pipe, in two jets as large as a man's body. From this fountain the water spread out into a pond of perhaps fifty acres, and then flowed off in a trout-peopled brook, large enough to turn a mill-wheel.

"After a dozen years of absence I have just revisited the homestead, and took my way towards Spring Pond. There were some well-remembered landmarks, but the maples and beeches and birches were all gone. The wooded bluff was a dry sand-bank. A few water-worn stones marked the place

* In *Harper's Magazine*, April, 1866.

where the spring had been, but it was waterless. The bright pond was a miry marsh, with here and there paths trodden by cattle in search of water. The trees had been cut down to supply fuel for a neighboring railroad—which, I was not sorry to learn, had never paid a dividend to its stockholders—and with them had gone sparkling fountain and clear pond and dancing stream. This is but a type of what is going on all through our older States. Unless men speedily grow wiser in this respect, they or their children will have abundant reason to deplore their folly when the great cry of drought, to which we are even now becoming accustomed, shall be heard season by season all over the land.

"Let us be careful of our trees. Preserve those which still grow upon mountain-sides and ravine-slopes, by fountains and springs. One woodman, with a keen axe, will destroy in an hour what it has cost a century to produce, and what a century cannot replace. A few cords of wood are, indeed, worth something; but many hundreds of cords are not worth as much as a perennial spring of water. A few acres added to our present corn-fields will be dearly purchased by cursing the land with drought and barrenness. In our Eastern States there is even now more need of planting forests than of felling them. 'Put in a tree; it will be growing while you are sleeping,' is good advice here and now, as it was in Scotland, when the Laird of Dumbiedikes is made to say the only wise thing which he ever said."

Besides their bearing upon the water supply, forests have a very important influence upon climate. They not only shade the ground from the burning rays of the sun, but the leaves of a few trees in full foliage, if spread out on the ground, would cover an acre; and every inch of this surface is an evaporating one. The temperature in a forest is, from this cause, perceptibly lower on a hot day than it is in the shade of a house or wall. The terrible hurricanes in some of our prairie States may, perhaps, be partially owing to the absence of forests. During a "hot spell" the ground becomes heated far above its ordinary temperature, and the atmosphere above it is proportionally heated and rarefied. Now let a cool current of air pass over this rarefied mass, and this cooler and therefore heavier air rushes in from every direction to fill the partial vacuum. When the science of meteorology comes to be somewhat more advanced, we may possibly be able to foretell hurricanes for some days in advance; but we can conceive of no way of preventing them except by removing the inducing causes. Not improbably the lack of forests may be one of these. Certain it is, that they are more frequent and destructive than they were when the region was better wooded. What the proper proportion is of forests to area, will vary with the climatic conditions of any region; but, in general, it may be said that it is greater in a hot than in a cold climate.

The actual existing area of forests must, in most cases, to a great extent, be a matter of approximate estimate. A very careful calculation was made about 1870 of the forest land of Europe and North America. According to this, there were in all Europe about 725,000,000 acres of forest, being 30 per cent. of the whole land surface. But the ratio varied greatly in different countries. In Russia there was 40 per cent. of forest, but the greater portion of this was in the northern part, the southern portion of the empire being very sparsely wooded. The great "Steppes" of the Black Sea region are almost treeless. In Sweden and Norway there was 34 per cent. of forest; in Germany, 26; in Italy, 22; in France, 17; in Holland and Spain, 7; in Great Britain, about 4 per cent. Spain, which ranks next lowest in this respect, needs more forest land than any other country in Europe; and there are not wanting those who ascribe her descent in the scale of nations to the destruction of her ancient forests more than to any other cause.

The same estimate gave to Canada about 900,000,000 acres, probably an over-estimate, unless we include the far north-west, where the forests, though covering great areas, have but few and small trees. To the United States were assigned 560,000,000 acres, or 34.7 per cent. of the land surface.

In 1875 the United States Commissioner of Agriculture attempted an estimate of the forest area of the United States, based, as far as possible, upon actual statistics. The entire area (Alaska and the Indian Territory being included) was put down at 2,311,544,959 acres, of which 583,346,836 acres, or 25.2 per cent., was forest. But the ratio varied very greatly in different States: from only 3 per cent. in Dakota, to 65.9 per cent. in Mississippi. The percentage of forest to the total area was:

In Arizona, 6 per cent.; Alaska, 30; Alabama, 63.5; Arkansas, 58; California, 7.9; Colorado, 10; Connecticut, 21.2; Dakota, 3; Delaware, 29.2; Florida, 50.6; Georgia, 62; Idaho, 15; Illinois, 16.9; Indiana, 34.8; Indian Territory, 8; Iowa, 14.1; Kansas, 5.6; Kentucky, 49.1; Louisiana, 59.1; Maine, 46.9; Maryland, 38.4; Massachusetts, 29.2; Michigan, 47.1; Minnesota, 17.1; Mississippi, 65.9; Missouri, 45.4; Montana, 16; Nebraska, 5.2; Nevada, 5; New Hampshire, 37.2; New Jersey, 28.1; New Mexico, 6; New York, 27.6; North Carolina, 64.2; Ohio, 28.4; Oregon, 25.2; Pennsylvania, 38.9; Rhode Island, 24.2; South Carolina, 60.6; Tennessee, 59.9; Texas, 26.7; Utah, 10; Vermont, 36.5; Virginia, 49.4; Washington, 33; West Virginia, 54.9; Wisconsin, 20.9; Wyoming, 8.

The forest area has certainly decreased very considerably in some sections since this estimate was formed. In the great lumbering States the native forests have been rapidly cut down for their timber, and in some of the Southern States — as Mississippi, Alabama, and Arkansas, where the proportion of forest was the highest—large areas have been transformed from forests to farms and plantations. Still, if the whole forest land were uniformly distributed, it might, perhaps, be fairly adequate to the necessity in the respect under consideration. But immense regions are almost bare of forests, trees being found only along the river courses; and the lack of wood for lumber and general building purposes is a very serious evil, even where the deficiency of wood for fuel may be supplied by the coal-mines. This is the case in those of the great prairie States where the forests form less than 20 per cent. of the total area, and on nearly the whole of the Atlantic slope of the continent. Of course it is still greater in the immense region where the ratio falls below 10 per cent. It may be said, in general, that in New England, most parts of the Middle States, and the lake region, not one more tree should be cut down unless another is set out to replace it; and that in large portions of Texas, California, Dakota, and Colorado, there should be five trees planted for every one cut down for any purpose. This topic will be further considered in the succeeding chapter on Lumbering Products.

The evils of deforesting a country have for many years attracted attention in Europe, and more recently in the United States and Canada. And a profession—that of Forestry—has gradually grown up, having for its object the preservation—not the destruction—of the forests. This new profession offers great inducements to those who are intelligently looking out for opportunities of profitable employment. As long ago as 1851 a special committee of the British Royal Association drew up an elaborate Forest Report, which was published by order of Parliament. Although referring especially to the British Dominions, nearly every suggestion embodied in this report is equally applicable to the United States. Of this report we present the essential features:

"1. Over large portions of the globe there is a wanton destruction of the indigenous forests. 2. Improvements have been introduced; and these may be extended by making still more stringent legal restrictions for the preservation or planting of seedlings in the place of mature trees removed; by the prohibition of the cutting down of trees until they are well grown, and, in case they produce gums, resins, or other valuable products, taking greater care not to injure the trees by improper tapping or notching. 3. Especial attention should be given to the preservation and maintenance of the forests occupying tracts unsuited to other culture, whether by reason of altitude or other peculiarities of physical structure. 4. It is a duty to prevent the excessive waste of the timbers useful for building and manufactures. 5. In a region to which the maintenance of its water supplies is of essential importance, the cutting down of the forests in the localities whence those supplies are derived should be prevented."

This last recommendation is the one of most pressing immediate importance to us. What, for example, is the use of spending $20,000,000 or more in building a new aqueduct for supplying water to the city of New York, if in a few years the region to be drawn upon by this aqueduct shall become so arid as not to be reliable for a constant and regular supply of water? It matters not that in the wet season there should be ever so much water running to waste from the dams and reservoirs, if in the dry season there is no supply. As a preliminary measure, the State should have absolute control of all the forest land in the region to be drawn upon, paying, of course, an equitable sum for the land thus appropriated. Without such provision the aqueduct might in time be as useless as are the ruins of those which bestride the Barcan desert.

Something looking in the right direction has been begun. Among the things done are the Timber Cultivation Act of Congress, and similar enactments in several States, and "Arbor-day" in some other States. It is something to know that on Arbor-day, 1876, there were 1,400,000 trees set out in poorly-timbered Minnesota, although the number set out was only a third as great the next year; and we are not told how many of the trees thus set out survive transplanting. If Arbor-day should result only in having village streets and some country highways lined with shade-trees, something will have been attained. If a few hundred sections of public lands now treeless should be forested, so far so good. If every farmer who has a rocky patch of land would set out upon it such trees as once grew there, very much would be gained, both by him and the public. If a few adjoining farmers would thus act in common, they would in time find constant brooks running in their ancient channels, which are now, except after a shower or the melting of the snow, as dry as the rocky ravines of the Sinai desert, down which running streams once coursed.

Our few great landholders — railway corporations, for example — could easily do what the largest British landholders have been doing for the last forty or fifty years, with such success as to warrant Mr. Brown, the author of the most thorough British book on Forestry, to say: "In England and Scotland, land unfit for high farming will, under wood and good management, at the end of 70 years, pay three times as much as any other crop." Or to cite the words of Mr. Franklin Hough, our best — one might almost say, our only — writer on Forestry: "If a piece of soil is quite valuable for tillage, its value will doubtless be greater for that use than for forests. The best land will, of course, produce the best trees, but the grain which they will yield will be worth more than the trees would be. But there are vast tracts almost worthless for grain, which will be worth much for timber."

Railroads must in any case have wood — for ties especially; and a railroad tie is a very perishable article. Those corporations which own great tracts of land will soon be forced to grow their own ties; and the sooner they seriously set about it, the better will it be for them. Instead of trying to force all their land upon the market, they should reserve a goodly part for this purpose. Every score of miles of track should have, closely bordering upon it, forest enough to furnish timber for ties, trestles, stations, and all the wood-work required. And, moreover, the value of the land adjacent to a forest would be greatly enhanced in many ways. The man who shall, fifty years hence, journey by rail from the Missouri to the Sacramento or the Columbia, should never be out of sight of a dense forest.

Fortunately for us, Government, National or State, is yet the great land-owner, and should be the great forester. It still owns most of the regions which are the sources of our great rivers. The more unfertile regions of Texas, Colorado, California, Dakota, and Arizona should be reserved for forests; and if now treeless should be made wooded. It does not need to be proven that this is practicable—is even not difficult of execution. But the work must be set about wisely. What is needed just now, more than any other one thing, is schools of Forestry, such as exist in Austria, France, and Germany. We have a Military Academy and a Naval Academy, all doubtless needful; but quite as much as either of these do we need a National Agricultural Academy and a National Forest Academy.

In Prussia there are about 20,000,000 acres of forest land, of which about 6,000,000 acres belong to the State, and are managed by it. The revenue from this forest land amounted, at the date of the latest reports, to about $10,000,000, of which about half went to defray the cost of management, including the expenses of the schools of forestry. From an elaborate Report on *Forest Management*, issued not long since by the British Parliament, we learn that

"In Germany the forest service is a State department, filled by youths of good position who are specially trained for the service, the period of training occupying five years. The would-be *Oberförster* must, after passing certain terms at a Government school, spend a year with an 'over-forester,' and then pass an examination as 'forest-pupil;' after which there is a two years' course at a forest academy, and an examination in scientific forestry, land-surveying, etc., when he becomes a 'forest-candidate;' then the other two years' practical study, during at least nine months of which he must actually perform the duties of a forester, after which comes the final Government examination, on passing which he enters the grade of 'over-forester-candidate.' After passing this examination, he is employed as an assistant in academies and control-offices, etc., receiving certain allowances. After five or six years of this probation he may look forward to being permanently employed. Thus we have at least five years spent in study, without pay, and the other five in probation, with little pay, before he is installed. Yet so great is the desire for forest service that there is no lack of competitors."

The forest service for the 6,000,000 acres of Prussia employs about 5000 persons, of all ranks, as regularly graded as in the army, from "foresters," through "over-foresters," "forest-masters," and "over-forest-masters," up to the "overland-forest-master," who is a member of the Ministry. The "foresters," numbering about 4000, answer somewhat to our cadets, or to our non-commissioned officers in the army and navy; "over-foresters" and the others to lieutenants, captains, and colonels in the army. Each forester has under his care from 1000 to 3000 acres of woods; the "over-foresters" three or four times as much; the "forest-masters" 60,000 acres or more. The result is that in Prussia

"The forests have all been surveyed, valued, and divided into blocks; and there are accurate maps representing the extent and situation of each forest district, and the description and age of the timber growing on each block. Whatever be the size of the forest, every tree is recorded, and a working plan is drawn up and followed, certain species being destined to longer or shorter growth, according to their promise of vitality or liability to decay. The maps form the starting-point of every true system of forestry."

In the great Bavarian forest-school of Aschaffenburg, the term of study is shorter; but in order to enter it the candidate must have passed the course of the higher school or "gymnasium," which includes the classics, mathematics, natural history, and chemistry. The pupils are usually from seventeen to nineteen years of age when admitted, and for the first year become apprentices, assisting in the practical work of a forest district. The course of study in the school itself occupies two and a half years; and not until the student has passed his final examination is he eligible for appointment in the forest service. The course of study comprises the following subjects:

"1. *Forestry:* General management, planning operations, valuation surveys, rotation and details of working plan, transport and sale of timber and other forest products. 2. *Natural Science*, with special reference to forest requirements; meteorological phenomena, organic chemistry, nutrition of plants, systematic botany and zoology, entomology. 3. *Mechanics*, *Surveying*, *Engineering*, and *Road-making*. 4. *Forest Legislation* and *Police*. Practical instruction is given in the laboratory, and excursions are made in the forests. Careful observations are also made regarding the influence of forests on the air and soil, their hygienic importance, and effect on climate."

In this chapter we have considered forests mainly with regard to their wide and intimate relations to water supply, climate, and the like. But their mere pecuniary value for timber and other products demands further elucidation. Do away as much as we can with the use of wood for fuel, for house-building, for ship-building, for machinery and implements, yet there will remain innumerable uses for which wood remains an absolutely essential, or at least the most convenient, material.

CHAPTER XXII.

LUMBER AND OTHER FOREST PRODUCTS.

IN many sections of the United States the forests have already been practically annihilated for the sake of the lumber produced from them. But there were, even in 1880, some of the most densely-wooded regions, especially in the South, where this industry had hardly been introduced, and where it has since that time been greatly extended. Thus, in 1879 Alabama produced lumber to the value of only about $1,500,000; the value in 1882 is set down at $8,000,000. The result of this will be the same as has been produced elsewhere, unless wiser means are adopted than have heretofore prevailed. The forests will disappear; and it must be borne in mind that it is very rarely that a tract from which the forest has once been cut down has any value for lumber. Hardly any attempt has been made anywhere to preserve or renew our forest lands. Indeed, we find only one effort in this direction. We are told by the special forestry agent of the Census Office that "The system of cutting only the large trees, and carefully protecting the remainder, prevails in Maine, and allows the forest to be profitably worked at stated periods, varying from fifteen to twenty-five years. Their permanence is thus secured. Considerable areas in Southern Maine are covered with second-growth pine, which furnishes a large proportion of the pine sawed in the State." Elsewhere we meet with such information as this: "The original white-pine forests of New Hampshire are exhausted. . . . The original white-pine forests of Vermont are practically exhausted. The estimated amount of merchantable black spruce standing May 31, 1880, was 755,000,000 feet, board measure. During the preceding year

199,000,000 feet were cut, and 16,200,000 feet were imported from Canada." At this rate the entire timber supply of Vermont would be exhausted in less than four years from 1880.

The general evils springing from the destruction of the forests have already been considered. We now present the statistics of the lumber industry for 1880. This, it will be seen, ranks among our great industries. It employed $180,000,000 of capital, gave employment to an average number of nearly 150,000 persons (and occasionally to at least half as many more), who received as wages nearly $32,000,000; and the whole value of the lumbering product was $233,000,000, of which the logs themselves were worth nearly $140,000,000. Table XXII. gives for each State the number of lumbering establishments in 1880, the capital and average number of hands employed, the amount of wages paid, the value of the logs, and the total value of all the products.

The products of the logs brought from the forests and reduced to lumber were: 18,091,356,000 feet of lumber, board measure; 1,761,788,000 laths; 5,555,046,000 shingles; 1,248,226,000 staves; 146,523,000 sets of headings; and 34,076,000 feet, board measure, of spool and bobbin stock. Dividing the amount of wages paid during the year by the average number of hands employed, and we have only $215 a year for each; but only a portion of those actually engaged in lumbering worked at this occupation continuously through the year. Still the mere work of felling the trees and hauling or floating the logs must rank low among our remunerative occupations.

The mere lumber, as such, constitutes only a small part of the real importance of our forests. Wood is indispensable for the manufacture of innumerable articles, each of which constitutes a great industry of itself. Take a single example of a considerable product of the forest which was practically unknown five years ago. Rags and similar fibrous materials, from which paper was formerly almost exclusively made, are wholly insufficient to supply the present demand for paper. "Wood-pulp"—that is, wood rasped or ground to an impalpable substance—enters very largely into the composition of wrapping-

SNAKING OUT LOGS.

See Note 16.

paper, card-board, paste-board, and of most printing-papers, and of not a few writing-papers. The newspaper which you read is, in effect, printed upon a sheet made in great part, sometimes almost wholly, of spruce, pine, birch, or poplar chips. The bark and rotten wood being cleared off, the sound wood is reduced to pulp in one of two ways: Either mechanically, by being ground

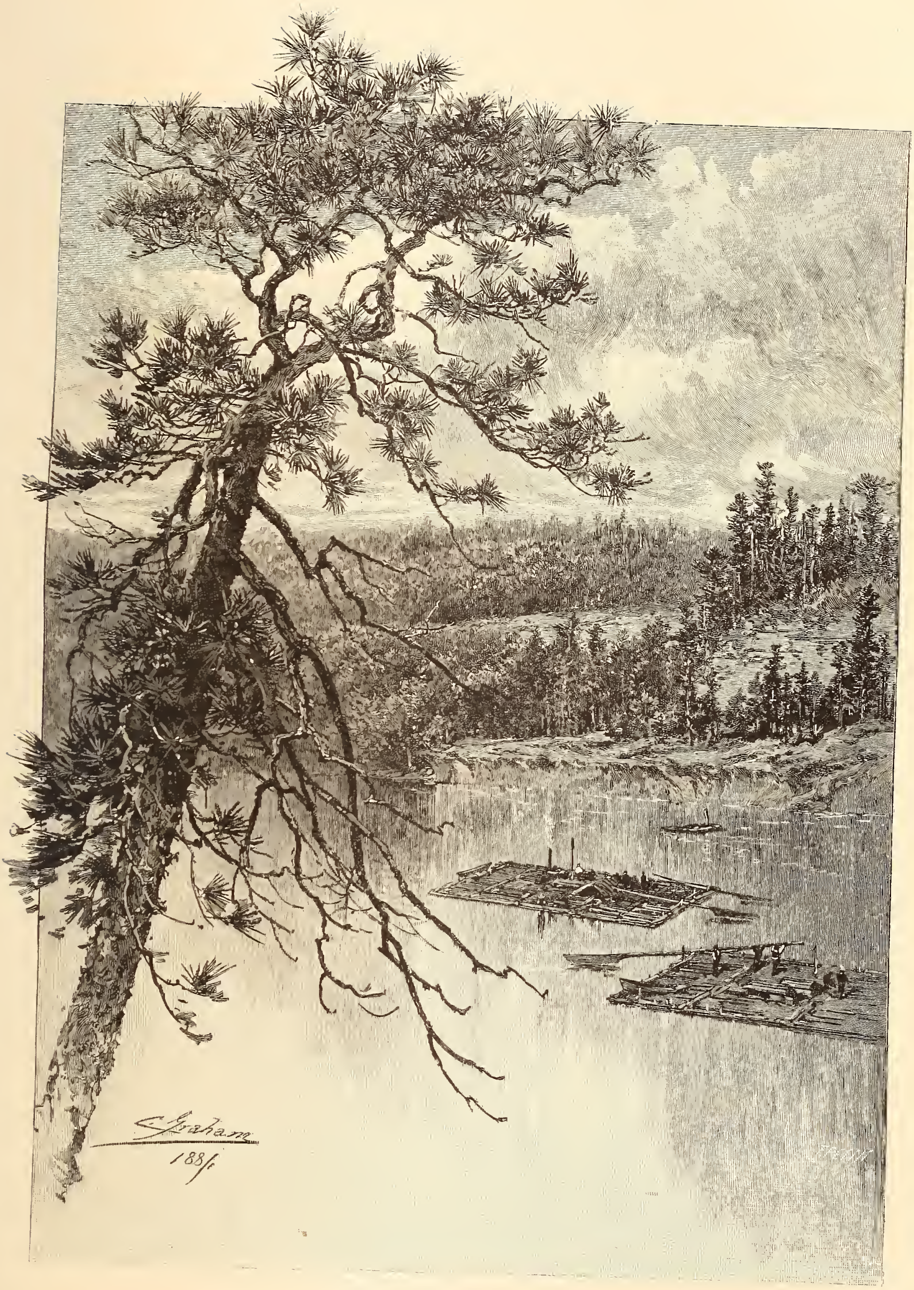
TABLE XXII.—LUMBERING AND ITS PRODUCTS.

STATES.	Establishments.	Capital.	Hands.	Wages.	Logs.	All Products.
	Number.	*Dollars.*	*Number.*	*Dollars.*	*Dollars.*	*Dollars.*
Alabama	354	1,545,655	1,647	424,156	1,517,986	2,649,634
Arizona	13	102,450	79	33,375	126,486	215,918
Arkansas	319	1,067,840	1,744	237,394	1,009,954	1,793,848
California	251	6,454,718	3,434	1,095,736	2,055,635	4,428,950
Colorado	96	481,200	877	112,931	654,500	1,051,295
Connecticut	300	657,300	707	178,336	609,024	1,076,455
Dakota	39	113,750	290	54,974	269,235	435,792
Delaware	86	259,250	391	40,694	229,763	411,060
Dist. of Columbia	1	25,000	25	6,000	32,000	50,000
Florida	135	2,219,550	2,030	562,249	1,763,617	3,060,291
Georgia	655	3,101,452	3,392	554,085	3,049,435	4,875,310
Idaho	48	192,460	173	33,367	213,691	448,635
Illinois	640	3,295,483	3,851	787,867	2,959,537	5,063,037
Indiana	2,022	7,048,088	10,339	1,571,740	9,290,428	14,260,830
Iowa	328	4,946,390	2,989	825,244	4,023,661	6,185,628
Kansas	146	262,975	516	66,757	421,738	682,697
Kentucky	670	2,290,558	2,601	671,939	2,238,888	4,064,361
Louisiana	175	903,950	976	200,063	1,106,280	1,764,640
Maine	848	6,339,396	6,663	1,161,142	4,754,613	7,933,868
Maryland	369	1,237,694	1,239	223,786	1,041,836	1,813,332
Massachusetts	606	2,480,340	1,970	431,612	1,827,497	3,120,184
Michigan	1,649	39,260,428	24,235	6,967,905	30,819,003	52,449,928
Minnesota	234	6,771,145	2,854	924,473	4,408,468	7,366,038
Mississippi	295	922,595	1,170	197,867	1,190,902	1,920,335
Missouri	881	2,867,970	2,503	669,644	3,113,049	5,265,617
Montana Ter	36	208,200	142	47,945	257,320	527,695
Nebraska	38	93,375	140	29,313	153,823	265,062
Nevada	9	132,000	35	9,892	151,790	243,200
New Hampshire	680	3,745,790	3,104	548,556	2,159,461	3,842,012
New Jersey	284	1,657,395	768	179,693	942,752	1,627,640
New Mexico Ter	26	74,675	172	24,240	100,145	173,930
New York	2,822	13,230,934	11,445	2,162,972	8,628,874	14,356,910
North Carolina	776	1,743,217	3,029	447,431	1,490,616	2,672,796
Ohio	2,352	7,944,412	9,317	1,708,300	8,603,127	13,864,460
Oregon	228	1,577,875	579	242,154	1,294,703	2,030,463
Pennsylvania	2,827	21,418,588	14,914	2,918,459	13,378,589	22,457,359
Rhode Island	49	144,250	152	33,143	116,085	240,579
South Carolina	420	1,056,265	1,468	221,963	1,170,088	2,031,507
Tennessee	755	2,004,503	3,718	549,222	2,006,124	3,744,905
Texas	324	1,660,952	3,186	732,914	1,909,794	3,673,449
Utah Territory	107	272,750	385	65,175	216,619	375,164
Vermont	688	3,274,250	2,511	426,953	1,939,775	3,258,816
Virginia	907	2,122,925	4,011	540,231	1,864,288	3,434,163
Washington Ter	37	2,456,450	499	200,539	1,174,005	1,734,742
West Virginia	472	1,668,920	2,183	459,945	1,307,843	2,431,857
Wisconsin	704	19,824,059	8,465	2,257,218	12,219,097	17,952,347
Wyoming Ter	7	26,700	38	6,380	24,725	40,990
Totals	25,708	181,186,122	147,956	31,845,974	139,836,869	233,268,729

into pulp by means of heavy millstones revolving rapidly in water; or chemically, by boiling the chips, under heavy pressure, in a solution of caustic soda. Without wood-pulp our great newspapers would not find it easy to procure the almost countless tons of white paper which they need, or our paper-hangers to cover our walls; and the paste-board boxes, which we find so convenient for many purposes, could not be made in their present numbers or at their present prices. Fortunes have been made, and are now making, by converting wood into paper.

The reported value of the trees growing upon a single acre of woodland exceeds all belief, unless there were corroborative facts and figures. We condense, almost at random, from the excellent *Forest Report* already cited:

"In *Maine* the average value of farm lands is about $13 per acre, woodland averaging about the same. But in districts where the lumber can be readily brought to market, the value of forest lands vies with the richest orange and grape soils in California or the sugar region of Louisiana. In Sagadahoc and Hancock counties the average value of woodland is $50 per acre. In York County, although the first, and in many cases the second, crop of white pine has been cut off, the quantity now growing has been increasing, and it is estimated that in a forest of fifty years' growth the wood is worth $250 per acre, and in one of seventy years' growth $500 per acre, on the stump. In Cumberland County the average value of forests, reckoned as woodland, is $80; timber land $120 per acre. In *New Hampshire*, in Sullivan County, the best forests yield sixty cords per acre, mostly hard-wood, worth, standing, $1 per cord, and 20,000 feet of soft lumber, worth from $2.50 to $5 per 1000 feet. In Grafton County many acres of spruce forests are valued at $1000, and of hemlock at $500 per acre. Large tracts of birch, for peg-wood, and of poplar, for paper-pulp, sell at $20 per acre; and it is estimated that the forests in the county average in value $50 per acre. In *Vermont*, in Lamoille County, about half the forest lands produce soft timber, and these lands sell at from $5 to $20 per acre, according to location and value of soil. The other half is made up of hard-wood varieties, of which the most valuable is the sugar-maple; and maple-orchards sell at $100 to $200 per acre. In *Massachusetts*, in Bristol County, the best growths of pine are worth $200 per acre. In a few instances old fields have been set out with pine timber, and in most cases the investment has proved judicious. In *Connecticut*, in Windsor County, the heaviest forests have all been cut down, and most of the forest area is too rocky and sterile to cultivate; but upon about one-fourth of the forest area pines and chestnuts grow so rapidly that in twenty or thirty years they will make boards twelve to eighteen inches wide. Land on



RAFTS IN THE DELLS.

See Note 17.

which timber is growing increases in market value every year. In Litchfield County iron furnaces have been in operation more than a century, and to supply them with charcoal the hills have been repeatedly stripped of their coverings; but after the trees have been cut down, most kinds sprout vigorously from the stump, and others spring up from the seed, so that if cattle are excluded the forest is soon renewed. Sprout-land, kept for wood, has proved remunerative, yielding every twenty-five years twenty-five cords per acre, worth $2 a cord, standing."

These data evince that in the New England States there is even now ample opportunity for the remunerative exercise of forestry. We find similar facts in abundance as we pass to the Middle States:

"In *New York*, in Washington County, all the accessible original timber has been cut off; yet there are some groves of hemlock, valued at $500 per acre, of pine, at $1000, and of oak and hemlock at fabulous prices. In Livingston County it is held that one-eighth of the land now under cultivation, if it were planted in forests for wind-breaks and fuel, would largely increase the agricultural resources and value of the county: a suggestion well worthy of consideration, especially, as elsewhere noted, in fruit-raising. In Otsego County many tracts, after the timber has been cut off, are kept for successive crops of hop-poles, the trees attaining the proper growth in about ten years; an acre often yielding 2000 poles, worth, standing, from $40 to $60. Good timber land is worth $50 per acre, and at that rate the wood product will pay for it, leaving the cleared land for net profit. In the southern part of *New Jersey* there are few forests remaining, and the farmers consider land from which timber has been cut too valuable for forest cultivation, though chestnut is excepted, on account of its rapid growth. In Camden County the few acres of white and black oak and chestnut of first growth are valued at $300 per acre; second growth at $30; first growth cedar, $600 to $800; second growth, $25 to $75. As evidence that the oftener chestnut is cut, the more the growth is multiplied, it is stated that the sprouts of one stump produced sixty railroad ties, worth 50 cents each. In *Pennsylvania* the wooded portions are very large; but many of them are so situated that the timber cannot find a market. In Bedford County, where there are twelve acres of forest to one acre under cultivation, the mountains are covered with pine, oak, and chestnut, and a tract of chestnut will yield per acre 3000 or 4000 rails for fencing, worth from $30 to $50, and so rapid is the growth of this tree that in sixteen years after the first cutting the land will reproduce an equal yield. In Lancaster County the wood of good timber land sells at $300 per acre, the land itself not included. Locust-trees are planted along the fences on farms, and are considered very valuable. In Chester County the best forests sell for $125 to $200 per acre, the land not included."

In the Southern States the forests themselves have been unremunerative, owing to the limited market for wood and lumber, arising from the deficiency of means of transportation. The Report says:

> "Beyond a quite limited use for building, and the demand for fences and railroad ties, there is scarcely any home market. A peculiarity of the forest lands in these States is a vast extent of second growth, mainly pine, covering soil mostly worn out by exhaustive cultivation, and abandoned. Included in the primeval forests yet remaining are extended tracts of yellow and pitch-pine, and immense swamps of cypress and cedar, varieties of oak, including live-oak in the Gulf States. Hickory, walnut, cherry, poplar, gum, and chestnut are among the valuable kinds generally diffused."

A change in this respect has begun, and the timber of these States is beginning to have a market value. But the first results of this change were unfavorable; notably so in *Virginia.* The people, exhausted by the results of the civil war, were perhaps forced to look only to present remuneration, irrespective of the future. The forests of some portions of the State afforded one of the readiest resources, and a wholesale devastation of them took place. In Pittsylvania County timber land decreased to 30 or 40 per cent. in five years; the wood cut down was sold at a merely nominal price, the main purpose being to get new land for tobacco and other crops. In Smyth County "timber lands vary in value from $3 to $25 per acre; in many instances the chestnut-oak is cut for the bark, and the timber is left to decay." In Roanoke County, "since the war, the indiscriminate destruction of forest for miles back from the railroad, for wood, has been highly disadvantageous." In James City County "two-thirds of the area is in forest; pine, the most valuable timber, is being rapidly cut into wood, shipped to New York, and plank shipped to Baltimore." In Henrico County "the destruction of the forests by both armies during the war was very great." Spottsylvania County "has 60 per cent. of its area in forests, of which 10 per cent. is timber land, valued at $20 per acre, and 50 per cent. land that will average fifteen cords of wood per acre, worth 25 cents per cord, standing." Buchanan County "abounds in forests heavily timbered with hard-woods, which, remote from rafting streams, can be bought at from 50 cents to $1 per acre." These statements, and numerous others to the same general purport, furnish abundant reasons why the maintenance of the forests should receive prompt and careful attention in Virginia. *North Carolina* presents conditions similar to those in Virginia. The Report says:

"Haywood County has about 80 per cent. of its area in forest, a great portion being mountainous. In many instances timber is considered a nuisance, and every means for its destruction are resorted to, even to placing it in huge piles and burning it to ashes. In Beaufort County fully 80 per cent. of the land area is covered with forest, one-half of which is of original growth; there are many saw-mills occupied in sawing lumber for the Northern and West India markets, and millions of cypress shingles are annually shipped. Alamance County contains 60,000 acres in original forest, besides a vast amount of land covered with second growth in different stages. Land worn out and abandoned as worthless has been restored, it is said, to its original fertility by a growth of pine, much of which now affords timber suitable for building. In Person County the original forests of hard-wood are being rapidly cleared up for the purpose of growing tobacco, the timber being mostly burned on the land. The forests of Madison County abound in timber—chestnut and locust, poplars five feet in diameter, and white pine from two to four feet in diameter and one hundred and fifty feet high; yet all this magnificent timber is worth from $10 to $12 per acre less than nothing—the owners paying at that rate for having it removed from the land in order to fit it for cultivation. In Gaston County it is still not uncommon in clearing land to kill a part of the timber by girdling, and cut down the remainder, burning it on the ground. Many of the old fields are densely covered with pines of thirty or forty years' growth. In Randolph County more than 67 per cent. of the area is yet in forests, which, with a railroad running near, would be very profitable. In Gates County the forests abound in pine timber, worth about $4 per acre; and the swamps in cypress and juniper, which, with shipping facilities, would be valuable."

If one will read these statistics with a map before him, he cannot fail to perceive that forest culture and forest management is one of the chief directions to which the industry of North Carolina should turn. Let her people not heedlessly cut down the forests in order to get two or three crops of tobacco, but preserve a due proportion of them as forests, and the lands of the State will be growing more and more valuable year by year. In natural physical conditions North Carolina is not unlike Spain. Let her not follow the bad example of that country in regard to her forests.

Georgia and *Alabama*, except in latitude and climate, bear many close analogies to the New England States. Both possess extensive water-power, and hence should become, to a considerable extent, manufacturing States. Both have abundant forests, and have good natural facilities for working up their forest products and sending them to market. Both, as lumbering States, should rank with Maine and Michigan, which cannot, with the wisest management, keep up the supply of the lumber required for the Union. Both of these States have, moreover, need for that regulation of the supply and distribution of water which is afforded by forests. In both States, therefore, forestry should have ample consideration.

The five Central States — *Ohio*, *Michigan*, *Indiana*, *Illinois*, and *Wisconsin*—present some special forest aspects. Originally they were far less densely wooded than the Eastern and Southeastern States, but fully one-third of their area was covered by forests, especially on the river-banks, where they are most needed. The timber, except in the case of the white pine of Michigan, is not largely exported from the neighborhood of its growth, but yet the local demand for it is sufficient to warrant its preservation; and so wooded land is not largely cleared up for the mere purpose of getting rid of the timber. The consequence is, that nearly 30 per cent. of the area of these States, taken as a whole, is still more or less wooded with timber of first or second growth. Were it not for the over-rapid cutting away of the pine forests of Michigan, the forestry of these States is not in a very unsatisfactory condition. Land, in most parts, is too valuable for cultivation to warrant the expectation that any large forests will be maintained; but the planting of considerable belts of forest-trees, for the purpose of sheltering orchards and cultivated fields, is in every way desirable.

The generally well-wooded State of Missouri lies like a wedge between this fairly-forested section and the half-wooded Iowa and Minnesota, and the almost treeless Kansas and Nebraska. In these last four States the creation of forests is a matter of paramount importance in every point of view.

In *Iowa* very successful efforts have been made in this direction. Thus, still citing the *Forestry Report:* "In Manona County a large portion of the farmers are cultivating timber, mostly cotton-wood, walnut, ash, and maple; some have thirty to forty acres planted, and many plant belts around each quarter-section." In Tama County "there are fully 50,000 acres of timber planted, all of which grows with great thrift." In Hardin County "our correspondent planted, ten years ago, one acre in trees—willows and cotton-wood—eight feet apart each way; finding them too thick, he cut out every other tree, and the product was 13 cords of wood, worth $4 a cord; the cost of cutting was 75 cents per cord; this would give a net profit of $84.50 on an acre of poor land for ten years. The average value per acre of the wheat crop of the State was just twenty cents more." In Crawford County, where "timber land averages only one acre to forty-five acres of prairie, large numbers of the more thrifty farmers have planted groves of maple, cotton-wood, black-walnut, and box-elder, which have grown with great rapidity; and the vast expanse of treeless prairies which a few years ago stretched as far as the eye could see in every direction, is now dotted over with beautiful groves, which greatly add to the wealth of the county." Plymouth County "has only a few acres of natural forest along the streams. The township of Lemars, when settled seven years ago, had not a tree; it now has 190 acres of planted forests and 15 miles of willow hedge."

In *Minnesota* "there is a wide-spread interest in the planting of forest-trees, which is assuming organized efficiency; there is also an extensive spontaneous growth of thrifty timber-trees on uncultivated prairies protected from fires. Many acres, once burned over annually, are now covered with a thick, young growth." This last statement is substantially repeated for various sections of the State, and indicates that nature is helping those who help themselves. "As soon as the prairies are protected from fire, groves of timber spring up." "Where running fires have been prevented, fine groves of oak are springing up."

This shows that the absence of forests in this region is not owing to any inherent defect of soil or climate.

In *Kansas* and *Nebraska* the percentage of forest to the total area is less than in any part of Europe, except Great Britain, and is certainly not more than one-fourth of what it should be, although "on original prairies forest-growth has for some years been increasing from two causes: the arrest, by cultivation, of prairie-fires, which has resulted in the spontaneous springing up, on uncultivated portions, of a thick growth of young trees; and by the planting of trees, stimulated by legislative encouragement and by assured success in respect to both growth and profit. In addition to the pecuniary gain, there has been a perceptible modification of the climate, especially in the assuaging of the severity of the once unimpeded winds." Naturally, perhaps, the trees planted have been too largely of the soft, quickly-growing kinds, and recently attention has been directed to species ultimately, though not so immediately, of more value.

California has especial need of forest-trees and forestry, and here, perhaps more than in any other State, has attention been turned to the introduction of foreign species of forest-trees. The *eucalyptus*, or "blue-gum" of Australia, has been more extensively planted than any other kind. So small is the proportion of forest, and so wide is the extent of regions where there are no forests at all, that there is ample reason for a confident belief that increasing attention will in future years be paid to this subject.

CHAPTER XXIII.

CONDITION AND PROSPECTS OF AMERICAN FORESTS AND FORESTRY.

THE foregoing chapter refers especially to the forest condition of the United States as it was in 1875, when an elaborate report thereon was prepared by the Agricultural Department, based, to a considerable extent, upon the Census of 1870. During the Census year 1880, and subsequently, still more elaborate investigations were carried on; but the results of these have been only partially published in isolated reports. From these and other sources we deduce some conclusions as to the present condition and future prospects of the country in the respect under consideration: The forests, as furnishing lumber for building and manufacturing purposes. Mr. Hough, in his Forestry Report for 1882, says:

"In looking forward to the probabilities of future supply of timber, we cannot expect (unless so far as it may be derived from Canada) any assistance worth noticing from foreign countries, and must substantially depend upon ourselves for whatever we require to meet the vast and varied wants of our population. Although in some instances the consumption may become less, as from the substitution of iron in naval and civil architecture, or of mineral coal for fuel, we can scarcely expect that the general demand will ever decrease; but that it will steadily advance with our increase in wealth and numbers; and that its supply must depend upon the growth within our own territory; and, as the native timber is exhausted, it must in a great degree be re-reared under the care and protection of man."

He lays it down as a general rule that trees will flourish in any region that was once covered with a forest growth, and also wherever grain of any kind can be cultivated without irrigation. In some regions trees of many kinds will flourish; in others the range of species is very limited; and to ascertain these conditions forms the main aim of forestry. He assumes that—

"The work of practical cultivation and protection must be undertaken by the owners of the land; for it is certain that no National or State Government or local municipality will spend its means in planting upon lands where the title is vested in private owners; and that no private owner will ever care for premises not his own. And, furthermore, that no tenant can ever be expected to plant lands where he is not to realize profits from the improvement; and that, in general, the cultivation of woodlands for a future supply implies a stability of ownership and a faith in the certainty of returns, which, although it may not be inviting to speculation, is still a positive and easily-computed addition to the wealth of the owner, reasonably sure in realization and profitable in amount. And that, with due forethought and intelligent care, there is no cultivation that better repays the attention bestowed upon it than that of forest-trees."

Government, whether National or State, has the right, which it should exercise, of imposing restrictions upon the undue destruction of timber growing on the land which it retains, and upon any that it may hereafter sell or grant to individuals or corporations. How much timber land yet remains in the possession of the National Government is wholly unascertained. Upon this point Mr. Hough says:

"Within the present limits of the original States the General Government has never owned lands, excepting in very limited areas and for certain specified uses. The public lands once belonging to or still owned by the General Government, acquired by cession, conquest, or purchase, originally amounted to about 2,835,606 square miles, of which (in 1882) a little over 40 per cent. have been surveyed. More than one-third of the unsurveyed part is in Alaska, and much the greater part of the remainder is among the mountains of the Territories. The amount of forest land, surveyed and unsurveyed, cannot be stated from any information within our knowledge; but it must be quite considerable, although much of it is remote from lines of transportation and unavailable for present use."

Mr. F. B. Baker, who was appointed "to investigate and report upon the forestry and forestry necessities of the States and Territories of the Mississippi Valley and east of the Rocky Mountains, presented, at the close of 1882, a Preliminary Report concerning this region, which embraces the States of Minnesota, Iowa, Missouri, Arkansas, Louisiana, Nebraska, Kansas, Texas, a portion of Colorado, and portions of the Territories of Dakota, Montana, Idaho, New Mexico, Arizona, and the Indian Territory. Of this vast region he says:

"The States of Missouri, Arkansas, and Louisiana are largely covered with native forests; and Arkansas, in particular, stands in need of facilities for bringing her lumber to market; and the day cannot be far distant when the cypress of Arkansas will be as well known as the pine of Michigan and Wisconsin."

The cypress of Arkansas has, indeed, come to be well known in domestic and foreign markets; but the latest statistics make it more than probable that the white pine of Michigan, Wisconsin, and other States will soon become a product of the past. Mr. Charles S. Sargent, the special agent in charge of the Forestry Statistics of the United States Census, says: "The entire supply of white pine growing in the United States, and ready for the axe, does not to-day (1882) greatly, if at all, exceed 80,000,000,000 feet; and this estimate includes small and inferior trees which a few years ago would not have been considered worth counting. The annual production of this lumber is not far from 10,000,000,000 feet, and the demand is constantly and rapidly increasing." At this rate of consumption the white pine of the United States would last just ten years, even supposing that there should be no increase in the consumption. But the quantity of pine lumber brought to market in 1882 was much greater than in any previous year, and unless this consumption falls off, the noble white pine will not find place in the Census Report of 1890. Mr. Sargent thus graphically sums up the existing condition of the white-pine forests of the United States:

"Fatal inroads have already been made into the great pine forests of the North Atlantic region. Its wealth has been lavished with an unsparing hand; it has been wantonly and stupidly cut, as if its resources were endless. What has not been sacrificed to the axe has been allowed to perish by fire. The pine of New England and New York has already disappeared. Pennsylvania is nearly stripped of her pine, which only a few years ago appeared inexhaustible. The great North-western pine States — Michigan, Wisconsin, and Minnesota—can show only a few scattered remnants of the noble forests to which they owe their greatest prosperity, and which not even self-interest has saved from needless destruction."

Nowhere, excepting in Maine, do we find any mention of white pine of second growth which has attained a size for marketable lumber; and a generation must, in any case, elapse before, with the wisest endeavors, any great addition can be made to the sources of supply of this timber. There is no other which can, to any extent, take its place, if we except the narrow belt of red-wood timber along the California coast. The yellow pine of the South is a very different tree, admirable for some uses, but only available to a few of those for which the white pine is specially adapted. It is a hard, resinous wood, of about the same weight as the white oak, or nearly twice as heavy as the white pine or spruce. We have been accustomed to look upon the supply of yellow pine as inexhaustible; but we are as far wide of the truth in respect to the yellow pine as we have been in respect to the white pine. Mr. William Little, of Montreal, the best Canadian authority upon the timber question, puts the matter in a form well worthy of our consideration. He says:

> "When people talk, as they sometimes do, of the inexhaustible forests of the South, they know little of the sawing capacity of the Northern mills, which could, in twelve months, convert the whole merchantable pine of the States of Georgia or Alabama into lumber, and be but six months in using up that of Florida or either of the Carolinas."

There is, undoubtedly, something of over-statement in this. Six months or a year would make very little apparent inroad upon the timber forests of the South. But the felling of these forests is increasing with unexampled rapidity under the growing demand for timber, not only for home use, but from abroad. Foreign capitalists are turning their attention in this direction. Hardly a week passes in which we do not hear of large purchases being made of timber lands in the South by Europeans, with the express and sole view of lumbering. American enterprise and capital is nowise behind in the race; and unless some check be placed upon this tendency, the South will, in a score of years, be as thoroughly stripped of its yellow pine and cypress as the North and West have been of their white pine.

But we return to Mr. Baker's "Preliminary Report on the

Forestry and Forestry Necessities of the Mississippi Valley," condensing some of his most important statements: Outside of the wooded States of Arkansas, Louisiana, and Missouri there remains an empire to which the subject of forestry is at this moment a vital one. In *Minnesota* the belt of forest is comparatively narrow; but when the first settlement of the region began, the north half was covered with white pine, and south and west of this was a large body of hard-woods of various species. "Of the total forest of the State, fully one-half has disappeared. The area of the State is about 54,000,000 acres, and only about 4,000,000 acres of hard-wood remain. The first settlers of *Iowa* found a considerable amount of timber on the banks of the Mississippi and its principal tributaries. This they proceeded to use after the manner of the American pioneer, particularly when he encounters timber on the Government lands. Nature has since been repairing damages; but native timber has long since ceased to be a matter of reliance." *Nebraska*, when opened for settlement, was almost entirely destitute of timber. "The Omaha land district, of 2,560,000 acres, comprised the most heavily-timbered district of the State, but the original plats showed but 75,000 acres of timber."

Kansas was originally somewhat less sparsely timbered than Nebraska. But Pike, who explored this region in 1806, "doubted if, beyond the first hundred miles from the present border of Missouri, the country could be settled on account of the absence of wood." But some fairly-timbered districts were subsequently discovered in various sections; and now, "after all the ravages of twenty years, the amount of timber in the State is estimated at 2,560,000 acres, or 4.92 per cent. of the whole area. *Colorado*, at the time of the discovery of its mines, twenty years ago, had a great body of pine, spruce, fir, and other trees covering its mountain sides. "In 1870 it was estimated that one-third, or possibly one-half, of the trees in the settled portions of the then Territory had been destroyed by fire and ceaseless slashing. Since that period railroads have penetrated the country, and have added to the destruction by consuming millions of ties. The original forest lands of Colorado are now being converted into deserts." This last statement of Mr. Baker deserves special attention, and fully corroborates the representations made in a previous chapter of this volume.

The immense regions comprised in the present Territories of the United States present some striking features of their own. *Dakota*, according to Mr. Baker, "is a prairie country, resembling in its general characteristics the adjoining portions of Nebraska and Minnesota." It is therefore a region in which tree-planting is especially indispensable and practicable. *Wyoming* "is a country of high plains and lofty mountains. In 1873 it was estimated that there were 2,000,000 acres of timber in North-western Wyoming. The business of cutting off timber for railroad ties has been going on for many years, the consumption being estimated at 500,000 ties per annum. Charcoal-burning and the demand for mining purposes have also diminished the native timber. The elevation of the country renders it liable to frost every month in the year except July, which enhances the difficulties here surrounding artificial forestry." The mountains of *Montana* were originally clothed with extensive forests of pine, cedar, and the like; but these forests have been ravaged by fire, and "it has been noticed that where the timber is once destroyed on these mountains it is not followed by a second growth." This last condition, which occurs elsewhere so frequently, and in accordance with no law as yet formulated, demands investigation. Why is it that in some cases — as the white pine of Maine — a second growth of the same species follows the cutting off of the original growth, while in other cases the second growth is entirely different, and in others there is no second growth at all? *Idaho* presents great contrasts of surface and vegetation. "The finest body of red-cedar on the continent exists in this Territory; and, on the other hand, there are 16,000,000 acres of sage-brush lands, which are, however, for the most part susceptible of irrigation, and so offer a field for tree cultivation." The general aspect of what may be styled the treeless region, lying west of Minnesota, Iowa, Missouri, Texas, and the Indian Territory, and stretching to the Rocky Mountains and beyond in the south, is thus summed up by Mr. Baker:

"Going west from the Mississippi the Missouri is encountered, lined with forests for the lower two hundred miles of its course; above that running through a comparatively deforested region. At the Missouri begins the ascent to the Rocky Mountains, the great field for the exercise of all that man has learned or can acquire of the science of forestry. This region, as the elevation increases, becomes more bare, and, to the eye accustomed to mountains and forests, desolate. The forest keeps up a gallant struggle along the streams which flow eastward to the Mississippi and Missouri—the Platte, the Kaw, and the Kansas—but finally disappears to a thin, winding, fringe of cotton-wood or willows; and for hundreds of miles the eye sees no more till the pine-covered slopes of the Rocky Mountains appear dimly on the horizon.

"The traveller coming within sight of the mountains, and then turning southward, comes to New Mexico, with its mountains ofttimes bare to their very summits, and at other times covered with piñon and pines. Its wide plains, watered by inconstant, treeless streams and occasional ponds or lakes, are traversed by but one stream of magnitude—the red, turbid Rio Grande—its banks destitute of trees or verdure, save where the patient Mexican has dug his *acequia*, or irrigating ditch. Then to the westward lies Arizona, a country of mountains, bearing everywhere the traces of volcanic action—extinct craters, lava-beds, and the veritable sandy desert. As the border of Mexico is approached, the barrenness increases. Nothing relieves it save where man has overcome it by irrigation. The Mexican does not rely upon trees for his fuel, but digs up the heavy, branching roots of the mesquite. If the traveller, when within sight of Pike's Peak, turns northward instead of southward, and keeps his course parallel with the mountains, his way will lead him over the high plains, better watered and less desolate than those of New Mexico, but equally destitute of trees."

In 1875 it was estimated that only 4.1 per cent. of the area of *California* was forest land. But the distribution is very unequal. Estimates are given for 45 of the 50 counties. In seven counties the ratio of forest to area was more than 20 per cent.; in five it was between 10 and 20; in eleven between 4 and 10; in nine it was less than 1 per cent. The most important native timber tree of California is the red-wood, which occurs in forests of greater or less extent. Of this tree Mr. Hough says, in his Forestry Report for 1882:

"These grand supplies of timber are now undergoing a rapid waste, and the lumbering operations have been carried on in the most reckless and improvident manner. The forests have been plundered and destroyed, with scarcely a semblance of restraint, until the time can be foreseen when they will be exhausted altogether, and we shall be left wholly destitute of those inestimable resources which, under judicious management, might be maintained for a long period, affording, besides their due supply of timber to the country, a substantial income to the treasury.

"The natural limits of the red-wood are relatively of small extent, not reaching far inland, and being limited to the western slope of the Coast Range, within the State of California; and although it may be propagated elsewhere, it never presents such vigor of growth and such wonderful development as among the fogs and in the humid atmosphere of the Pacific coast. Considerable portions of these native forests have come to full maturity, and the quality of the timber thus matured will not improve in the future, nor its quantity increase. It is quite proper that such timber should be used when at its greatest value, and that the Government and the country should derive the greatest possible benefit from this use; but there are other portions which are now gaining in value, and would continue to do so for many years to come, if suitable regulations for their protection were devised and stringently enforced. The red-wood shows an unusual tendency to reproduction; and there are large areas, from which the timber has been cut away, and which are now lying waste, in which every condition favorable to new plantation exists, as we have evidence in the growths but recently taken from them. We cannot but regard these localities as peculiarly valuable for timber culture, and this still more from the fact that, from their broken surface, they are worth little for any other use."

Within a year or two the red-wood has come into special favor as an ornamental wood, and the demand for it for this purpose has greatly increased in this country and in Europe. As a consequence, the felling of it has assumed greatly augmented proportions, and under circumstances which threaten the rapid extinction of this invaluable forest-tree. As these pages are being written we find the announcement that a "Red-wood Lumbering Company" has been organized in Scotland, with a capital of $4,500,000, which has purchased from 50,000 to 70,000 acres of red-wood forest, mostly in Humboldt County, for which (including lumbering machinery, etc.) $1,500,000 was paid. Such a foreign company can have but one object in view: that of realizing the most money in the shortest time. This can be done by denuding their purchase — a third of the county — of its red-wood forests, as quickly as possible; for there is a present demand for all of this lumber which can be brought to market.

If the land belonged to private owners, there might be no way to prevent this impending devastation; but most of the red-wood lands still belong to the Government, as do, indeed, a considerable part of all the remaining forest lands in the Union; and in respect to all these the recommendation of Mr. Hough cannot be too strongly urged:

"We do not hesitate," he says, "to recommend that not only the red-wood forests, but also the land, still belonging to the Government, from which these forests have been destroyed, should be set apart for forest culture and management, under such regulations as, upon careful inquiry, should be deemed proper, and as experience may suggest; and these plans, with reference to the red-wood forests of California, may be applied with equal reason to other great bodies of timber still belonging to the Government, upon the Pacific coast and elsewhere. In whatever plan it might be thought proper to adopt, the main object should be to secure the greatest possible benefit to the country at the least expense, and for the longest period of time."

The general outlines of a comprehensive plan to prevent the destruction of timber upon the forest lands still in the possession of the Government may be easily laid down. The first thing to be done is to have an accurate survey made of all these lands, so that the precise nature of every square mile shall be ascertained. Then all large bodies of timbered land should be withdrawn from sale or grant, and placed under regulations calculated to secure an economical use of the present timber. When it becomes advisable to permit the timber to be felled in any locality, the right to do this should be put up at public auction, the Government retaining the title to the land and all the young timber growing upon it, which should be reserved and protected for future supply. The privilege of cutting timber should be by lease for a specified short term — yearly perhaps — with the right of renewal upon specified conditions. There should be no renewal unless all the conditions of the former lease had been complied with; and the Government should have the right to terminate the lease at any time, for sufficient cause. The condition of all these woodlands should be inspected at frequent intervals, precisely as with all other public property, or as a merchant or manufacturer regularly takes an account of stock: for every tree has its value. The cardinal principle to be always kept in view, is that — except in special cases, where the land would be decidedly more valuable for other uses — our present National forest lands should be reserved for this sole purpose; the growth being kept up where it is now ample, and restored where it has been reduced; and also tracts now treeless should be planted and preserved, wherever economically possible.

Most of the forest land owned by the Government has comparatively little value for other purposes, but much of it is invaluable for this. How far and in what manner Government, whether National or State, can foster tree-culture by private individuals, by offering premiums for tree-planting, or remitting taxes upon woodlands for a specified time, or in other ways, is a matter to be considered separately. The great thing of present concern is to conserve the national forests.

It may be hoped that the granting of extensive tracts of land to railroads or other corporations will be discontinued. Whatever necessity may once have existed for this has come to an end. Above all things, not an acre of forest land should ever be allowed to pass into the hands of foreign corporations. A railroad has a permanent interest in the future prosperity of the country through which it passes, for the amount of its income is mainly dependent upon the productions of the region near its line. A foreign lumbering corporation has no such interest. Its sole object is present and immediate profit from the trees now growing, and the sooner that is secured the better for it, no matter how much future generations may suffer from its greed.

We have dwelt upon the question of forests and forestry under its various aspects, and with much detail, in the full persuasion that it is the important question of the day—the one upon which hangs the most momentous issues which are pressing upon us. We are fully convinced that unless the matters involved are wisely settled by the present generation, we shall have entered upon that downward path which so many other nations have trodden before us.

From the sketch in a preceding chapter, of the thorough training given in the great German Schools of Forestry, some idea may be gained of the kind and degree of knowledge which is there called into requisition in this profession as yet almost unknown among us. We need all this and far more, for the field in which it is to be exercised is immeasurably wider. We need men who shall be to our forest interests what thorough farmers and mineralogists and engineers are to the industries in which they minister. The want is beginning to be felt, and will be supplied. Shall it be supplied from abroad, or from the ranks of the young men of our country who are on the lookout for opportunities in life? Mr. Hough says, almost doubtingly: "We are convinced that among those educated in European schools of forestry, many persons could be found in every way qualified for these duties; and, should occasion arise for their employment, that they could be had, upon the assurance of a permanence of position and reasonable pay." We are firmly convinced that the occasion has already arisen for this employment, and that it is one which presents inducements worthy of the highest ambition, opening a wide field for science and skill, and promising ample reward to those who are willing to seek it.

CHAPTER XXIV.

THE PROFESSIONS.

OUT of the 17,392,099 persons in the United States engaged in all industrial pursuits, the Census classes 4,074,238 as occupied in "Professional and Personal Services." The list, as thus made out, is a rather curious one. The following is the number of persons engaged in each occupation; but in this chapter we shall speak only of those printed in italic letters, these being the avocations most commonly designated as "professions," in distinction from other callings in life:

Actors, 4,812. *Artists* and *Art Teachers*, 9104. Barbers and Hair-dressers, 44,851. Boarding and Lodging-house Keepers, 19,058. *Clergymen*, 64,698. Clerks and Copyists, 25,467. *Dentists*, 12,314. Domestic Servants, 1,075,655. *Engineers* (Civil), 8,261. Hotel and Restaurant Keepers, 45,527. *Journalists*, 12,308. Laborers, 1,859,223. Launderers, 121,942. *Lawyers*, 64,137. Livery-stable Keepers, 14,213. *Musicians* and *Music-teachers*, 30,477. Officers of United States Army and Navy, 2,600. Officials of Government, 67,081. *Physicians* and *Surgeons*, 85,681. *Teachers*, 227,710. Watchmen, 13,384. Others in Professional Services, 270,547.

All the "professions," as commonly considered, number only 498,927 members, of whom more than half are teachers. The labor which they perform is chiefly mental, and it is presumed that this labor demands for its successful exercise the highest native capacities, and a longer and more severe training than is requisite for other avocations; and that these professions afford the highest rewards for capacity, industry, and energy. Undoubtedly this was in former times the case. Through the learned professions and through that of arms lay the chief avenues of advancement; and they did engross the best talent of the day, and paid better, in wealth and honor, than other avocations. The eyes of the aspiring were turned almost wholly to one or other of these professions. The case is very much altered in our days, and those who are watching for opportunities for a successful career should look about them with the eyes of the present rather than of the past. An occupation which was advisable at some former time may be an undesirable one now.

Some of the professions—as that of the artist and the musician—demand genius of a special character, without the possession of which no industry will command success. If a man has that special genius he will most likely follow its bent, almost regardless whether his chosen path leads to poverty or riches. To give advice to such persons does not come within the scope of this volume.

The Clerical Profession, in theory, at least, stands apart from all others in this respect. It is held that no one can rightly enter upon its functions unless he have a strong, inward call thereto. In most religious bodies the aspirant for the sacred office must not only aver that he believes himself to have such a call, but must also convince the proper ecclesiastical authorities that his persuasion is well founded. In any case it is to be desired that the young man who proposes to enter the ministry should have a clear view of what he may fairly expect to lie before him.

At the very outset there is one strong inducement. The pathway to entering the profession has been carefully smoothed and levelled. Schools and seminaries have been provided and so endowed that he can practically be educated without cost to himself. And then, again, he may be quite sure, if he completes his course with even tolerable credit, that a place will be standing open for him. But, on the other hand, he may be quite as certain that his path in life will lead to no marked pecuniary advantage. Only in very exceptional cases is the salary of a clergyman a large one; not unfrequently it is meagre. No clergyman can expect to become rich by the mere exercise of his profession;

but he may reasonably expect a comfortable maintenance from it; and, moreover, the very fact of his being a clergyman gives him an honorable place among men. It is sometimes urged that the clerical profession is overcrowded: that there are more clergymen than are required to fulfil the functions of the office. In one sense this is certainly not true. There is far more Christian work to be done than can be performed by the sixty and odd thousand pastors now in the field. But the salaries of clergymen, as a rule, are certainly low. This, however, is owing to causes quite apart from the usual laws of supply and demand, which hold good in most other cases. It is said that if the salaries of all the clergy of all denominations were equalized, there would not be more than $500 for each; and the proportion of high salaries is not large. Surveying the matter in its mere pecuniary aspect, it may be said that the minister must look upon his profession as one which will probably involve no little self-sacrifice. It may be *his* duty to make that sacrifice, if need be, but it by no means follows that the churches should call upon him to make it.

We hear much idle talk of the "decline of the pulpit" and the "waning power of the churches;" but the truth is that the visible institutions of Christianity are now, as they have always been, an important factor in our American civilization. Without them we should never have become what we are; and deprived of them we should speedily become lamentably different from what we are. We believe that never was the Christian Church, and the pulpit, as its most prominent exponent, a greater power among us than it is to-day. Every man who calls himself a Christian, by that very act acknowledges it to be his bounden duty to labor for the weal of the church of which he is a member. It may not be *his* duty to seek the office of the ministry—in the great majority of cases it will not be; but he is none the less held to sustain those who, as he believes, are called to do this. How much of his means shall be thus sacredly devoted — not *given* as alms or charity— to this purpose, cannot be settled by any universal rule. But the man who devotes less to this purpose than was prescribed by divine law to the ancient

Hebrews, may be well assured that he falls short of fulfilling his self-acknowledged obligation to his Heavenly Master. Very many should do much more; and there is little reason to apprehend that too much will in any case be thus set apart. And this duty is an ever-present one. The man who has been niggard in this respect all his life long, makes small amends by leaving bequests, however large, to be paid after his death. It is a duty to be performed personally, not a mere debt which may be discharged vicariously.

In many respects the profession of the *Teacher* resembles that of the clergyman; but there is this important difference: the clergyman enters upon his profession as a life-long work; the teacher very often takes it up as a temporary occupation, to be abandoned when something better presents itself, or as a means of support while preparing himself for other work. This is still to a very large extent the case with teachers in our public schools; becoming less so, as our system of public education becomes developed and improved.

There are many more persons occupied as teachers than are classed as such in the Census Report of "Occupations." This professes to include professors in colleges and regular instructors in private schools, as well as public-school teachers; and in all the number is set down at 227,710. But in the special enumeration of our common schools, alone, 236,019 persons are reported as being engaged as teachers in these schools, of all grades. Of the public-school teachers 106,099 were males and 129,400 females; and of these 15,834 were colored. There were in all 225,880 public schools; of these 5430 are described as being "high-schools, or having high-school departments." The number of public-school buildings was 164,832, having, in all, sittings for 8,968,731 pupils. The average salary paid to the teachers was $236 per year; but the schools are kept open, upon an average, only a little more than six months of the year.

Table XXIII. gives for each State the number of public schools, the value of the school property, the entire expenditures, the total amount paid for the salaries of teachers, and the average monthly salary while employed. It also gives the percentage of "illiteracy" in the several States. By illiterates are here designated all persons, of more than ten years of age, who are returned as "unable to read." The proportion of these to the whole population above the age of ten is 13.4 per cent., their number being 4,923,451. But many who are able to read are unable to write; the number of these being 6,239,958, or 17 per cent. of the population above the age of ten. The ratio of illiteracy is much the greatest among the colored population. The whites of native birth who are unable to write form 8.7 per cent. of all; those of foreign birth, 12 per cent. of all.

The statements embodied in this table, however, afford only a partial view of the pecuniary side of the profession of a teacher in our public schools. The average $36.21 per month includes all teachers of every age and grade of skill and ability. In not a few even of the elementary schools, however, are high talents brought into exercise and good salaries received. In each of the more than 5000 "high-schools" are several teachers employed, whose positions and salaries are in every respect desirable. In addition to these are college professorships, still more desirable.

Still, our public-school system, taken as a whole, is not so organized and administered as to afford adequate inducements for choosing the profession of a teacher. In the lamentable lack of even tolerably remunerative occupations for women, this is better than many—perhaps better than most—now presented; and there are in many localities more applicants for such positions than there are positions to be filled. Unfortunately, also, in too many cases the administration of our public schools has become a part of the machinery of party politics. Many school commissioners have political friends to reward, or political enemies to punish; hence teacherships are not unfrequently bestowed for reasons with which fitness for the place has little to do.

For young men the profession of a public-school teacher as yet offers scanty inducements as a permanent occupation. Of itself, it leads to nothing; and a man who can do even fairly

TABLE XXIII.—COMMON-SCHOOL STATISTICS: 1880.

States.	Value of School Property.	Total Exp. for Schools.	Teachers' Salaries.	Average Monthly Salary.	Total of Pupils.	Daily Attendance.	Schools.	Illiteracy.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Number.*	*Average.*	*Number.*	*Per Cent.*
Alabama...	299,599	430,131	388,128	21.66	187,550	123,366	4,629	43.5
Arizona....	113,074	61,172	56,744	76.54	4,212	3,213	101	16.7
Arkansas...	237,302	382,637	331,750	37.62	108,236	65,619	2,678	28.8
California ..	6,949,983	3,031,014	2,271,219	76.99	161,477	106,179	3,446	7.1
Colorado ...	710,503	400,205	190,839	57.97	22,804	13,807	514	5.9
Connecticut.	3,454,275	1,335,234	986,989	40.36	118,529	72,725	2,601	4.2
Dakota	214,760	183,257	81,311	31.31	13,718	8,530	508	3.1
Delaware...	440,788	172,455	110,931	27.99	26,412	17,439	519	15.3
Dist. of Col..	1,206,355	438,537	287,872	67.74	26,439	20,637	415	15.7
Florida	134,384	117,724	99,177	25.50	43,304	31,477	1,135	38.0
Georgia....	1,046,026	653,464	616,096	30.26	237,124	151,759	5,939	42.8
Idaho	31,000	38,411	33,421	54.73	5,834	3,863	128	5.5
Illinois	15,876,572	7,536,682	4,587,046	38.78	704,041	431,643	15,203	4.3
Indiana	11,907,541	4,504,407	3,175,275	38.90	512,201	320,577	11,623	4.8
Iowa	9,460,775	4,347,119	2,907,446	30.59	425,665	260,813	12,635	2.4
Kansas	4,723,043	1,819,561	1,101,211	27.56	246,128	144,343	6,148	3.6
Kentucky ..	2,143,013	1,162,944	1,025,659	26.00	292,427	192,331	7,392	22.2
Louisiana ..	752,903	455,758	373,081	40.02	81,012	55,808	1,669	45.8
Maine	3,027,602	991,297	777,692	28.20	150,811	106,763	4,736	3.5
Maryland ..	2,083,013	1,395,284	1,117,145	42.19	149,981	85,449	2,551	16.0
Mass.......	21,660,392	4,720,951	3,906,516	58.49	316,630	235,664	6,604	5.3
Michigan...	8,982,344	3,112,468	1,920,618	29.05	362,459	263,775	8,608	3.8
Minnesota..	3,460,458	1,622,919	956,571	33.84	186,544	103,378	4,784	3.7
Mississippi .	553,610	679,475	653,351	29.10	237,065	156,824	5,166	41.9
Missouri ...	7,810,924	3,092,332	2,261,058	36.33	486,002	260,540	10,329	8.9
Montana T..	132,507	68,202	53,785	63.21	4,667	2,986	159	4.8
Nebraska ..	2,061,059	1,079,666	565,651	31.38	100,871	62,510	3,286	2.5
Nevada	282,870	212,164	131,019	89.45	8,918	5,385	185	7.3
N. H.	2,328,796	568,103	415,777	28.12	64,670	48,943	2,552	4.2
N. J.	6,298,500	2,039,938	1,391,550	41.42	205,240	116,360	3,241	4.5
New Mex. T.	13,500	28,973	28,002	30.67	4,755	3,150	162	60.2
New York..	81,235,401	9,936,662	7,438,277	40.71	1,027,938	551,958	18,615	4.2
N. C.......	248,015	383,709	328,717	21.27	256,422	164,570	6,161	38.3
Ohio	21,643,515	7,707,630	4,972,541	37.79	752,442	495,924	16,473	3.6
Oregon	249,087	316,885	212,348	38.63	37,437	26,563	1,068	4.1
Penn.	25,919,397	7,306,692	4,504,802	33.52	950,300	622,351	18,616	4.6
R. I........	1,895,877	530,167	401,738	48.25	42,489	27,453	850	7.9
S. C........	407,256	367,259	308,230	25.21	134,842	99,070	3,077	48.2
Tennessee..	1,025,858	786,088	634,587	28.45	291,500	205,081	5,688	27.7
Texas	130,762	782,735	713,908	28.01	176,245	123,473	6,692	24.1
Utah	372,273	170,887	130,187	42.48	25,792	17,513	383	5.0
Vermont...	1,427,547	452,693	361,039	21.81	73,237	47,206	2,597	4.9
Virginia ...	1,246,283	889,862	716,153	26.63	220,783	129,006	4,876	34.0
Wash. Ter..	161,309	112,615	95,582	35.97	14,780	10,546	531	5.7
W. Va.	1,686,999	720,967	527,099	27.61	143,796	92,132	3,874	12.1
Wisconsin..	5,287,570	2,163,845	1,570,997	29.96	299,514	185,276	6,588	4.0
Wyoming T.	40,500	28,504	25,894	60.23	2,907	1,920	55	2.6
Totals....	211,411,540	79,339,814	55,745,029	36.21	9,946,160	6,276,398	225,880	13.4

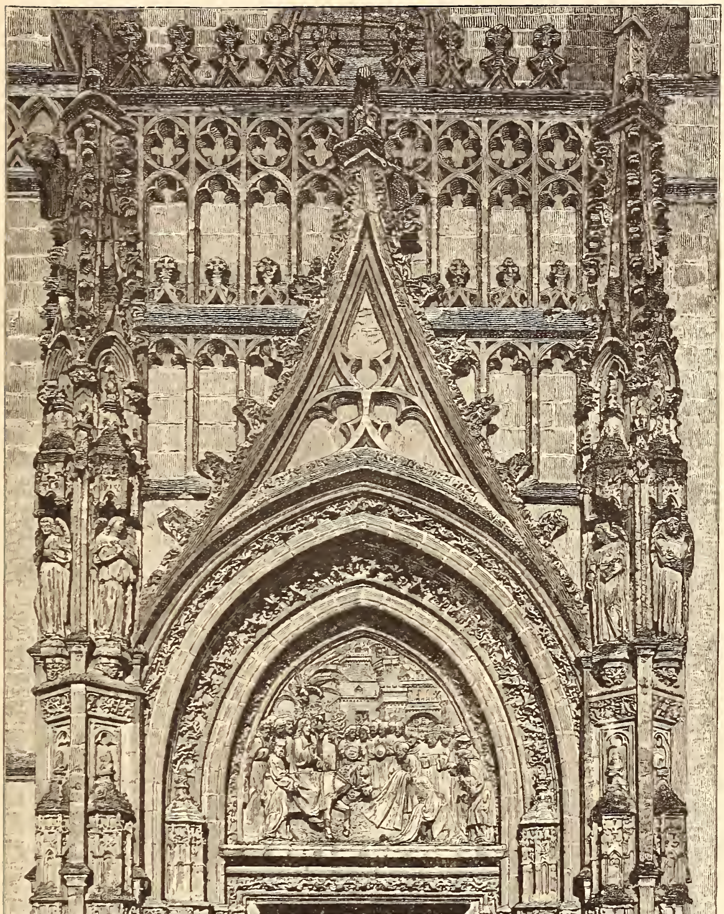
well in it, may almost certainly do much better elsewhere. Its demands upon the vital energies are more continuously exhausting than are those of any other profession. The zealous public-school teacher must always work under high mental tension. The clergyman may pause in the writing of his sermon, and refresh himself by exercise or repose before resuming his pen;

the over-wearied lawyer may leave his office or shut out his clients when he will, and is not constrained to work when he is not in working trim; but the public-school teacher must work straight on during school-hours, and usually those hours are altogether too long, for he has much work to do when his pupils have been dismissed for the day. And, moreover, his work is almost always to be done in a closely-packed and ill-ventilated room. A properly ventilated school-room, even in our best appointed schools, is an exception to the general rule.

The teacher has nominally his "vacation;" but the chances are that his salary is not sufficient to enable him to spend this in such a way as to derive much benefit from the intermission in school work. He, of all men, needs relaxation—not merely relaxation for a few days or weeks once a year, but daily relaxation, and the amenities of social life. All this applies with still greater force to the female teacher, for her more delicately-wrought system still more urgently demands that relaxation which her yet more meagre salary renders still less attainable to her.

Nothing can be worse economy than this under-payment to teachers in our public schools. Next to the family stands the common school, in the importance of its influence upon the training of the young. A good school may, indeed, do much towards mitigating the evils of a faulty home, while a bad school will do much to thwart the salutary influence of the best home; and without a good teacher there can be no good school.

The State is in a wide sense the guardian of all its children. But the State can only, in exceptional cases, interfere with home arrangements. Unless the parents are grossly and notoriously unfit, the State must leave their children under their own unrestricted control. For this there is perhaps no remedy. The State cannot see to it that there shall be no unfit parents; but it can and should see to it that there are no unfit teachers—none who are unfit for the office by reason either of want of character, or by want of capacity and attainments. And, except in the rarest instances, good teachers cannot be had without paying them a proper salary. It is sometimes said that public-



MAIN ENTRANCE TO THE CATHEDRAL, SEVILLE.

See Note 18.

school teachers get all they are worth. This we do not hold to be true. But, if it were true, so much greater would be the urgency that teachers should be made worthy of far better payment than they usually receive, and should receive all they are worth. Public schools should attract to themselves not a little of the best talent of the community.

For high success as a teacher, capacities are required fully equal to those demanded in either of the other professions. The teacher must, of course, be master of the science which he proposes to impart; and, as all sciences are progressive, he must keep fully up with the general movement. The instructor who should to-day undertake to teach any one of the sciences as he learned it while a student, would soon find himself the laughing-stock of his pupils. The successful teacher must be a diligent student; and so interwoven are all branches of knowledge, that it is not enough for him to be thoroughly conversant with the one which it is his special province to teach. He must be a well-read man; and the wider the circle of his reading, so much the better in many respects. The teacher must, also, not only have mastered the subjects upon which he is to give instruction, but he must diligently cultivate the art of imparting that knowledge. He must be able to inspire his pupils with a love for their studies; and he cannot do this unless he himself loves them.

The teacher is not merely an instructor, but he is also a law-giver and a judge. He not only makes laws for his pupils, but he is also the sole tribunal for trying offenders. But, though in a sense an absolute sovereign, he is also an elective one. If his subjects cannot depose him, they can leave his dominion at will. He can, therefore, permanently hold his place as law-giver only by making just and wise laws, and by administering them justly and wisely. Still further, he is not only a law-giver, but he is the executive who enforces his laws. He must, therefore, have the power of command; and that man is the best commander whose orders are so given that they, as it were, enforce themselves—the man in regard to whom "to hear is to obey." Lacking this inherent or acquired power of command, the teacher lacks—whatever else he may have—one of the prime requisites for his profession. He may, perhaps, become a successful doctor or lawyer or clergyman, but not a successful teacher.

The Medical Profession is, in every respect, one worthy of the utmost consideration. Its highest rewards are very high, and its demands are proportionally exacting; but they are of a sober kind. Men may be urged by a strong, inward impulse, born, perhaps, from the conscious possession of peculiar gifts, to become painters or musicians. Men may be urged by a like inward impulse, to which is superadded a belief in an immediate call from on high, to become clergymen. But no such special summons, from within or from without, conscripts a young man into the ranks of the healing art. No one says to himself, "I must be a surgeon or a physician, or I can be nothing which I should be." Of course he must be fond of his profession, if he would succeed in it. And fortunately every man likes, or comes to like, the doing of that which he has learned to do well.

The young man who meditates entering the medical profession should look well at what he is doing. In the first place, the preparatory steps are long. It may be assumed that he has already acquired a collegiate education, or something equivalent to it, and will therefore have reached an age at which, in most avocations, he can earn something—most likely can support himself. But the future physician has yet some years of seed-time before he can begin to reap his harvest; and these are expensive years. The theological student has instruction provided for him free of charge; and, if need be, all or nearly all his expenses for living are supplied to him. The medical student has no such swimming-bladders provided for him. Then again, when he has received his diploma, and has a right to call himself a doctor, he is not in the position of the divinity graduate for whom a pulpit of some kind is presumably waiting. The young doctor must find his patients, and it behooves him to look carefully to the choice of a place of residence. A great city certainly presents the strongest apparent inducements. Where there are so many patients, there must be room for still other practitioners. This is true. In the medical profession, as in all other vocations in life, there is room, and always will be room at the top; and if a man has the faculty of climbing, and has won the first rounds of the ladder, every upward step grows easier than the last had been.

Then again, medicine is eminently a progressive science. Each day adds something to its developments. New facts are always coming to light, and these often overset old theories. The great principles of jurisprudence are so well and clearly defined that they stand as accepted axioms. Our law is essentially the "common law" of England; and that is essentially the civil law of the Roman empire. In divinity there are, indeed, sects and denominations and "schools" enough; but within each of these there is little or no room for fresh research. No Christian teacher expects to be wiser than his Bible; few or none expect to go behind or beyond the creeds, catechisms, and other symbols of their respective churches. A clergyman of thirty may be as profound a theologian as he will ever be. Calvin wrote his great "Institutes" before he had reached that age.

But the healing art, in all its departments, is a changing one. Diseases, it would seem, are continually assuming new types. At all events, new remedies and new modes of treatment are continually proposed and advocated. The physician who deserves to succeed must keep himself abreast with his profession. He must be able to decide intelligently, not only what new modes should be adopted, and to what extent, but—which is of quite as much consequence—what should *not* be adopted.

The physician stands in more intimate relations to his patients than the lawyer does to his clients, or perhaps even than the pastor does to his flock. To no other man, therefore, is an unblemished personal character more absolutely indispensable. There have been great and successful lawyers whose lives have been notoriously bad; there have been famous authors whose characters were more than questionable. But no physician whose character is not above any taint of reproach need hope to attain—or, if he attains it, to retain—professional renown.

One other requisite to success in the medical profession is a pleasing manner. The very presence of a physician in the sick-chamber should be of itself a cordial, more efficacious in cases not a few than any actual medicine could be. Without in the least disparaging the intrinsic value of medicines, it is certain that their efficacy is greatly enhanced by the faith of the patient; and the patient's faith in the prescription resolves itself almost wholly into faith in the prescriber. While it is by no means necessary that the medical attendant should profess—of which he can never be certain—that his treatment will inevitably effect a cure, he should at least assure himself that it is the best one to be adopted; and should so deport himself as to inspire his patient, and his patient's friends, with a like confidence.

To the man who has the capacity and the persistency needed for performing the high duties devolving upon the physician or surgeon, there are few avocations which hold out as high or as certain promises of success. Those who cannot, or will not, do the work belonging to the profession, will most likely fail—as they ought—in reaping its rewards.

The Legal Profession is, in some aspects, more tempting than any other. The lawyer must, indeed, study long and hard before he can begin to practise, and must usually work longer and harder than most other men before he attains any notable success. One of the most alluring things pertaining to the profession of law is that it affords the most frequent avenue to political and civil honors and emoluments. The bench, it may be assumed, will almost invariably be filled from the bar. In our National and State legislatures the ratio of lawyers has always been out of all proportion to their numbers as compared with the whole population. This tendency is, perhaps, less noted than formerly; but still, if one has his eye upon public life, a preliminary legal training is a decided advantage.

Indeed, a somewhat careful reading of law is worth the while of many who have no design to practise it as a profession. But, simply as a profession, it is confessedly overcrowded. There are too many lawyers for the amount of law business to be done; and such is the nature of the most lucrative parts of this business, that they are likely always to be engrossed by a few practitioners. The very highest rewards in the legal profession are, doubtless, higher than in any other. The salary of the most accomplished divine or professor, the practice of the most skilful physician or surgeon, falls far below the fees earned by a few leaders of the bar. The high prizes are higher, but the proportion of blanks is by so much the greater. We know of every lawyer who has notably succeeded, but we do not hear of the far greater number who have failed.

The Literary Profession.—There is no State or organized Territory of the Union which has not ten or more periodicals; and Idaho was the only one which in 1880 was without its daily newspaper. The whole number of periodicals was 11,314. Of these, 971 were published daily, 8633 weekly, 1167 monthly, and 116 quarterly. The average issue of each daily newspaper was nearly 4000; of the other periodicals, about 2700; but some of the periodicals of all classes issued more than 100,000, so that the circulation of by far the greater number was necessarily much below the average. Of these periodicals, 10,515 were printed in English, 641 in German, 49 in Scandinavian, 41 in French, 26 in Spanish, and the remainder in 10 other languages. There were 8863 periodicals devoted to news, politics, and miscellaneous reading; 284 to trade and commerce; 173 to agriculture and horticulture; 114 to medicine and surgery; 248 to education; 553 to religious topics. The "religious" periodicals were issued in advocacy of the tenets of twenty-four recognized denominations. The Methodists had 75; the Roman Catholics, 70; the Baptists, 63; the Presbyterians, 42; the Episcopalians, 33; the Evangelicals, 27; the Lutherans, 22; the Jews, 16; the Congregationalists, 14; the Second Adventists, 12; and smaller numbers for the other sects; while 96 were classed as "unsectarian." Rhode Island and Florida were the only States not having a religious periodical.

The number of periodicals published in the several States is only partially determined by their respective populations. New York had 1411; Illinois, 1017; Pennsylvania, 973; Ohio, 774; Iowa, 569; Missouri, 530; Indiana, 467; Michigan, 464; Massachusetts, 427; California, 361; Kansas, 347; Wisconsin, 340; none of the other States having as many as 300. There is a very marked tendency in journals to concentrate in the large cities. The number of journalists is given in the Census Report as 12,308, being only a little more than one journalist to each periodical. In New York there were 2111; in Pennsylvania, 1005; in Illinois, 937; in Massachusetts, 698; in Iowa, 516; and smaller numbers in other States. The number set down as journalists is undoubtedly much less than those more or less regularly engaged in furnishing matter for the periodical press, and who find it a profitable employment.

Journalism, using the term in its widest sense, presents many opportunities for those actively engaged in other employments. There are many persons who make considerable additions to their earnings by writing more or less frequently for periodicals. So great is the circle of readers, and so wide are the bounds of their tastes and requirements, that very little written for periodicals which is really worth being read, fails to find a purchaser among the publishers and editors, who act as intermediaries between the writer and these readers. But there is no end of that which is written and not printed or worth printing; and much that is printed is not read or worth reading.

A very large part of what is written and paid for is done by persons who have some other avocation than that of authorship. Even the editors of most journals and periodicals usually write little themselves. Very few men or women among us are distinctively authors by profession; and even in Europe it has been well said that "authorship is good for a staff, but not for a crutch." Very many persons have gained renown by writing books; but the number who have gained wealth, or even competency, in this way is quite limited. Leaving out of view a few exceptional cases, the best books in almost every department of knowledge have been written by men who did not live by their books. They either had an inherited competence, or were regularly engaged in some gainful occupation. The Census reports only 1131 "authors, lecturers, and literary persons," of whom 811 were males, and 320 females.

Still authorship, pursued as an incidental rather than as an exclusive occupation, furnishes numerous remunerative opportunities. Many a one can write an occasional magazine sketch or newspaper article, which will bring a good price, when he could not produce enough of these to earn a comfortable livelihood. He would, in a few articles, tell about all he knew.

If a man, like Prescott or Bancroft or Motley, have a competence to start with, or if, like Emerson or Longfellow or Bryant, he have an assured profession to rest upon, he may well devote his leisure — and the busiest man has more leisure than he is apt to suppose — to authorship. The busiest lawyer or physician, the most earnest clergyman, the most active teacher or college professor, if he have the right talent, may write more than one good book during his lifetime, and thus build a monument for himself. A few great rulers or soldiers or statesmen live in after-times; but apart from these, literary fame is the only enduring one. The fame of the greatest orator or lawyer or physician or divine, as such, dies with them, or at most lives for a generation. A single good book carries one down through ages.

If, however, a young man really resolve upon making literature the business by which he is to live, his best course is to seek an engagement as "journalist" upon some newspaper or periodical. He must content himself with beginning low down; but there are continual chances to rise, provided always that one has in him the faculty for rising. An established literary reputation, of course, goes for much with publishers and editors, just for the reason that it goes for much with readers and buyers. An editor would gladly accept a poem by Bryant or Longfellow without even reading it, because he knows that people will buy the magazine because it contains the poem.

The aspirant for distinction and payment in periodical literature should bear in mind that he must adapt his writings to the medium through which he hopes that they will reach the public. It would be useless to offer a novel to a medical magazine, or a poem to a railroad journal. Of all forms of composition, mere verses—no matter how perfect is the rhyme and how accurate the number of syllables in a line — are the least likely to find acceptance. Probably short stories, of not more than eight or ten pages of an ordinary magazine, or half as many columns in the "story papers," are more likely to meet with success than any one other kind of article. Every literary periodical must have a good supply of these, and is very glad to pay for such as it accepts. The able editors, to use a phrase quite common among them, "have offered to them ten times as many tolerably good stories as they have space for; but are always in want of very good ones."

One essential to a good tale is that it be fresh, either in subject or in mode of treatment, or better still in both. A mere imitation of a good story — no matter how clever the imitation may be — does not go very far towards making up a good story. If any story has made a decided "hit," it is sure to call out a host of imitations, very like the original one, for it seems a very easy thing to tread in the track which some one else has laid out. The closer the imitation is, the more likely is it to be "respectfully declined," if offered to the periodical who printed the one imitated. The besetting sin of most persons when they begin to write is to attempt to portray scenes of which they know nothing, and characters the like of which have never come before their eyes. A young woman living in a country village must take it upon herself to describe metropolitan balls and parties, and send her heroine to the opera and the picture-gallery, even if she refrains from English mansions, German castles, and Italian palaces. All this will be quite sure to be so much labor thrown away.

Sketches of incident and character enter largely into our current periodical literature. If a person has a quick eye for discerning the pathetic or the humorous, and has the faculty of portraying in words what he sees, this affords one of the most promising openings for literary effort, and more especially if facility in the use of the pencil be added to that of the pen. The person who can design cleverly, as well as write clearly, need never lack profitable employment. Such a person may, with perfect confidence, make literature a profession for life.

Not a little depends upon the appearance of the manuscript submitted to an editor. Let it be assumed that the contributor

THE GATES OF GHIBERTI.

See Note 19.

spells correctly and falls into no gross grammatical errors; yet, if the manuscript be illegibly written, it has very little chance of receiving a careful perusal. If the powers of the editor are sorely tasked to make out the written words, he cannot have much left to appreciate any vigor of thought or grace of expression which may be hidden under those obscure hieroglyphics. A manuscript submitted to an editor, especially if the contributor be a stranger to him, should be as legible as a printed page, in order to have even a tolerable chance of success. Other things being at all equal, the most legible manuscript will have the greatest probability of acceptance. A prize was once offered for a tale, and Edgar Allan Poe, then quite unknown, was one of the competitors. His offering gained the prize, mainly because the manuscript was so clearly written that the judges could easily decipher it. It was an exceedingly clever story; but its cleverness would most likely have missed recognition had it been hidden under a half-legible chirography. If one who hopes to be a contributor will not favor the editor by writing legibly, he cannot reasonably expect the editor to favor him by a severe effort in reading.

Most paying periodicals have at least an approximate rate of payment, based upon the length of an accepted contribution. Some, however, pay much more liberally than others. No first-class periodical will accept anything for which it is not ready to pay current rates; and usually those writers whose names have a pecuniary value demand and receive much more than these. So, also, papers, the preparation of which requires special labor, special knowledge, or costly travel, are paid for at special rates, usually arranged by agreement. As to the remuneration received for such articles, no general rule can be established. A very convenient way of measuring the length of an article is that of counting how many thousand words it contains. This is the mode of measurement usually adopted by periodicals. The best-paying periodicals — in the absence of any special contract — pay ten dollars for a thousand words; two-thirds of that rate is more often paid; half as much is probably quite as frequent as either; a quarter of it is not unusual, especially for translations.

The clerical and legal professions are almost wholly engrossed by men. Of the clergy, only 165 were women; of the lawyers, only 75. In the medical profession women were not quite so sparsely represented: of 85,671 doctors, 2432 were females. In most other professional avocations the disproportion between the sexes was less strongly marked. Of the 30,477 musicians and teachers of music, 17,295 were males and 13,182 females. Of the 9104 artists and teachers of art, 7043 were males and 2061 females. Of the 4812 actors, 2992 were males and 1820 females. In the profession of teaching alone do the females outnumber the males.

The various professional employments not comprised in what are generally styled "the Learned Professions," will be considered in their appropriate places in this volume.

CHAPTER XXV.

MANUFACTURES AND MECHANICS.

IT is not easy to draw any tolerably close line between the manufacturing and mechanical industries. Both are employed in transforming raw material, otherwise useless, or nearly so, into forms in which they subserve man's necessities. In both human labor is brought into exercise, and in each of them other mechanical forces are employed. The manufacturer and the mechanic both use machinery, for the simplest tool or implement is as truly a machine as is the most elaborate engine or loom. Perhaps the most convenient classification is to include among "manufactures" all those industries in which the larger portion of the result is produced directly by machinery, and to designate, in a general way, those as "operators" who direct the action of the machinery; while those industries in which human labor predominates over machinery are designated as "mechanical," and those engaged in these industries are called "workmen."

The Census Report includes mining and fishing among manufacturing and mechanical industries, which employ, in all, 3,837,112 persons, of whom 3,205,124 are males and 631,958 females—86,677 males and 46,930 females being from ten to fifteen years of age. The following is a classified list of the several occupations, with the numbers engaged in each:

Apprentices to trades (3857 females), 44,170. Bakers (1063 females), 41,369. Blacksmiths, 172,726. Bleachers and dyers (649 females), 8222. Bookbinders (5491 females), 13,883. Boot and shoe makers (21,007 females), 194,079. Brass-workers (737 females), 11,568. Brewers and maltsters (61 females), 16,278. Brick and tile makers (68 females), 36,052. Broom and brush makers (642 females), 8479. Butchers, 76,241. Cabinet-makers (480 females), 50,654. Carpenters and joiners, 373,143. Carriage and wagon makers (138 females), 54,589. Cigar-makers and tobacco-workers (10,668 females), 77,045. Clerks in manufacturing establishments (193 females), 10,114. Clock and watch makers and repairers (1818 females), 13,820. Confectioners (1800 females), 13,692. Coopers, 49,138. Cotton-mill operatives (91,479 females), 169,771. Curriers and leather-finishers (200 females), 29,842. Engineers and firemen, 79,628. Fishermen and oystermen (65 females), 41,352. Glass-work operatives (564 females), 17,954. Gold and silver workers and jewellers (1967 females), 28,405. Gunsmiths and locksmiths (195 females), 10,572. Harness, saddle, and trunk makers (1601 females), 42,973. Hat and cap makers (3855 females), 16,860. Iron and steel work operatives (402 females), 114,530. Lumbermen and wood-choppers, 43,382. Machinists, 101,130. Manufacturers and officers in manufacturing companies (407 females), 52,217. Marble and stone cutters, 32,842. Masons, brick and stone, 102,473. Millers (77 females), 53,440. Milliners and dress-makers (281,928 females), 285,401. Miners (79 females), 234,228. Painters and varnishers (266 females), 128,566. Paper-mill operatives (6719 females), 21,430. Photographers (451 females), 9990. Pianoforte makers and tuners (37 females), 5413. Plasterers, 22,083. Plumbers and gas-fitters, 19,383. Potters (589 females), 7233. Printers (3456 females), 72,726. Quarrymen, 15,169. Rubber-factory operatives (2058 females), 6350. Saw-mill operatives, 77,050. Sewing-machine operatives (5805 females), 7505. Ship-carpenters, riggers, etc., 17,452. Shirt and collar makers (8660 females), 11,283. Silk-mill operatives (9211 females), 18,071. Steam-boiler makers, 12,771. Tailors and tailoresses (52,098 females), 133,756. Tinners (1037 females), 42,818. Tool and cutlery makers (535 females), 13,749. Upholsterers (542 females), 10,443. Wheelwrights, 15,592. Wire makers and workers (245 females), 7170. Wood turners and carvers (193 females), 12,964. Various manufacturing, mechanical, and mining occupations not specified, 242,479.

Steam-power and Water-power used in Manufactures.

The power of human muscle would be wholly inadequate to move the machinery employed in the various branches of manufactures. Steam-power and water-power are used as the main motive force for driving machinery. In estimating the capacity of a steam-engine or water-wheel, what is called a "horse-power" is taken as the unit of measurement. One "horse-power" is that which would raise 33,000 pounds to the height of one foot per minute. This is considerably more than the actual power of a horse, and about eight times as much as can be exerted by a man. So that the 3,500,000 "horse-power" of the steam-engines and water-wheels employed in manufactures in the United States is equal to that which could be exercised by 28,000,000 men for the same purpose. If to this we add the steam-power employed upon railroads and steamships, it appears that all the men in the United States could not perform one-third of the work done by the steam-engines and water-wheels.

Table XXIV. shows for each State the number of establishments in which steam-power or water-power is employed in manufactures; the number of water-wheels, and their horse-power; the number of steam-boilers and engines, and their horse-power; and the percentage of increase of horse-power in 1880 over 1870.

The total increase in 1880 over 1870 in the steam and water power employed in manufactures was 45.38 per cent., the increase in the former being much greater than in the latter. In 1870, 48.18 of the power employed was water-power and 51.82 per cent. was steam-power; in 1880 there was 64.07 per cent. of steam-power and 35.93 per cent. of water-power. The steam-power in 1880 was equivalent to 2,185,458 "horse-power;" the water-power was equivalent to 1,225,379 "horse-power." Wherever water-power exists, under circumstances where it can be brought into use, it will, of course, be utilized for manufacturing purposes, since it costs little except for the machinery required.

Water-power, to be available upon any large scale, must be constant up to a certain point. The river must have sufficient water at its lowest stages to turn a certain number of water-wheels; and it is of little consequence how much more water there may be at high stages. Indeed, a great excess of water at flood-time above the usual flow is a disadvantage, by rendering it necessary so to place the works as to render them safe during flood-time. A river with a large and nearly uniform flow of water is required for manufacturing purposes. Large and costly dams are in many cases constructed in order to equalize the flow of water from season to season, and for the different hours of the day. These dams form reservoirs which store up the water during the night, when the wheels are not running, and let it off, at a regulated rate, during working hours. Many of these dams are very large and costly, and their construction involves the utmost knowledge and skill of the civil engineer, in order to render them capable of withstanding the enormous pressure which they must endure. The breaking of such a dam has often involved an immense loss in life and property. Water-power, to be of any use, must be so located as to be accessible. While the

TABLE XXIV.—STEAM AND WATER POWER IN MANUFACTURES.

States.	Establishments.	Water-power.		Steam-power.			Total Horse-Power.	Per Cent. of Increase in 1880.
		Water-Whe'ls.	Horse-Power.	Steam-Boil'rs.	Steam-Eng's.	Horse-Power.		
Alabama	1,257	931	11,797	616	551	15,779	27,576	47.06
Arizona	21	8	160	15	14	370	530	488.89
Arkansas	729	149	2,024	555	545	13,709	15,733	105.77
California	1,000	205	4,850	990	779	28,071	32,921	29.76
Colorado	181	52	1,849	158	152	3,953	5,802	160.76
Connecticut	2,028	1,784	61,205	1,670	1,124	57,057	118,232	47.10
Dakota Ter.	79	36	803	56	55	1,421	2,224	586.42
Delaware	317	232	4,785	365	254	10,643	15,428	80.80
Dist. of Columbia.	115	15	880	127	118	2,263	3,143	66.38
Florida	244	70	939	291	193	6,208	7,147	93.16
Georgia	2,074	1,917	30,067	948	799	21,102	51,169	33.80
Idaho	67	48	1,136	23	23	546	1,682	177.56
Illinois	3,722	751	17,445	4,143	3,445	126,843	144,288	67.69
Indiana	4,066	1,143	21,819	3,889	3,634	109,960	131,770	31.29
Iowa	1,546	1,093	20,363	1,229	1,068	33,858	54,221	37.11
Kansas	578	299	7,611	426	396	13,468	21,079	158.67
Kentucky	1,767	653	9,012	1,636	1,494	45,917	54,929	38.82
Louisiana	402	13	90	491	430	11,256	11,346	......
Maine	1,918	2,887	79,717	747	511	20,759	100,476	26.27
Maryland	1,532	1,004	18,043	1,202	914	33,216	51,259	58.10
Massachusetts	5,173	3,046	138,362	5,105	3,096	171,397	309,759	68.02
Michigan	3,581	1,746	34,395	4,109	3,085	130,352	164,747	55.64
Minnesota	964	650	28,689	760	569	25,191	53,880	167.54
Mississippi	893	301	3,449	676	635	15,001	18,450	47.93
Missouri	2,428	537	8,162	2,448	2,128	72,587	80,749	46.65
Montana Ter.	63	39	954	31	31	544	1,498	......
Nebraska	262	245	5,495	128	126	2,999	8,494	156.64
Nevada	26	6	108	27	23	608	716	......
New Hampshire	1,653	2,122	69,155	598	456	18,595	87,750	13.85
New Jersey	2,226	1,213	27,066	2,253	1,619	72,792	99,858	71.76
New Mexico Ter.	78	69	932	19	19	427	1,359	49.18
New York	11,776	9,752	219,348	8,101	6,672	234,795	454,143	35.82
North Carolina	2,323	2,370	30,063	699	616	15,025	45,038	36.00
Ohio	6,684	2,080	38,641	7,081	6,215	222,502	261,143	49.80
Oregon	443	373	9,255	196	176	4,334	13,589	64.18
Pennsylvania	10,381	7,075	110,276	12,095	7,913	402,132	512,408	40.80
Rhode Island	608	386	22,240	1,164	476	41,335	63,575	51.27
South Carolina	1,259	1,057	13,873	592	509	11,995	25,868	73.24
Tennessee	2,108	1,382	18,564	1,074	967	33,388	51,952	36.78
Texas	1,334	174	2,508	1,229	1,167	28,026	30,534	134.08
Utah Ter.	243	214	3,535	55	55	1,154	4,689	87.56
Vermont	1,582	2,138	52,226	378	272	11,088	63,314	23.37
Virginia	2,768	2,339	37,464	982	899	19,710	57,174	15.24
Wash. Ter.	70	46	1,185	96	61	3,210	4,395	55.69
West Virginia	1,190	670	9,454	934	816	28,456	37,910	38.71
Wisconsin	2,154	2,022	45,356	1,879	1,366	60,729	106,085	65.18
Wyoming Ter.	10	2	38	18	18	717	755	119.48
Totals	85,923	55,404	1,225,379	72,304	56,483	2,185,458	3,410,837	45.38

cañons of the Colorado and Gila contain an immense water-power which will, probably, never become available as such; that of Niagara may be utilized to any desired extent.

The districts in which available water-power exists, though large in themselves, are small when compared with the entire area of the United States. The Mississippi, below its junction with the Missouri, affords no water-power, because there is no fall of water. The low-lying Gulf States are necessarily without water-power, for the same reason. In New England, the Atlantic States, from Virginia northward to New York, and in the prairie States of the West and North-west, the water-power is already utilized to very nearly its full capacity. The Penobscot, the Kennebec, the Merrimac, the Connecticut, the Passaic, the Genesee, the Susquehanna, the Delaware, the Potomac, the Shenandoah, the James, and the Ohio now turn about as many mill-wheels as they are capable of turning. The table shows how many of these there are. In portions of North Carolina, Georgia, Alabama, and Tennessee there is an immense amount of available water-power not yet utilized; and there can be no doubt that these States will, consequently, become great manufacturing States. It will not be many years before they will not only manufacture all the cotton-goods required for their own consumption, but will also, probably, to a large extent, supply the great agricultural States of the West. There is no more promising opening for the investment of capital and the exercise of skill and industry than in manufacturing in those Southern States which have an abundance of accessible water-power.

Steam-power presents some marked advantages over water-power. It can be employed almost anywhere within a reasonable distance from the coal-mines; in the most densely peopled city as well as in the country. Steam-power is more constant than water-power, except in the favored localities. The manufacturer knows precisely what amount of steam-power is at his disposal on any day of the year; and he can increase the quantity at will by simply putting up new engines. Hence, as the table shows, the use of steam increases more rapidly than that of water-power in almost every State in the Union.

Table XXV. shows, for 1870 and 1880, for the principal branches of manufacturing industry, the total amount of steam and water power used; the number of operatives employed, the amount of horse-power for each operative, and the percentage of increase of the steam-power and water-power in 1880:

TABLE XXV.—STEAM AND WATER POWER, AND OPERATIVES.

Industries.	1870.			1880.			Per Cent. of Increase.
	Total Horse-Power.	Hands Employed.	Power per Hand.	Total Horse-Power.	Hands Employed.	Power per Hand.	
Cotton goods	146,040	135,519	1.08	275,504	185,472	1.49	88.65
Flour and Grist Mills	576,686	58,448	9.87	771,201	58,407	13.20	33.73
Iron and Steel	170,675	77,585	2.20	397,247	140,978	2.82	132.75
Lumber, sawed	641,665	149,997	4.28	821,928	147,956	5.56	28.09
Paper	53,218	17,910	2.97	123,912	24,422	5.07	132.84
Silk goods	1,911	6,699	0.29	8,810	31,337	0.28	361.02
Woollen goods	85,101	77,870	1.09	106,507	86,504	1.23	25.15
Worsted goods	8,016	12,920	0.62	16,437	18,803	0.87	105.05

There is a marked tendency in manufactures towards concentrating the work in large establishments, having much capital and employing a great number of hands. In 1870 there were in the United States 252,148 manufacturing establishments, employing 2,053,996 hands—men, women, and children—being an average of 8 employés to an establishment. In 1880 there were 253,852 establishments, employing 2,738,995 hands, being 10.7 employés to an establishment. Thus, while the number of manufactories did not increase to any appreciable extent, the number of hands increased 33.3 per cent., the ratio of increase being a little higher than that of the entire population. In the Census Report males above sixteen are counted as men, females above fifteen as women, and all persons below those ages as children. The men employed as operatives increased 25.5 per cent., the women 64.4 per cent., the children 58 per cent. In 1870 the average wages paid to operatives was (in gold) $302 a year; in 1880 it was $346. The cost of food—especially of meat—was greater in 1880 than in 1870; the cost of clothing was less: probably the entire cost of maintaining a family was about the same; so that the general condition of the two and three-quarter millions of operatives was more favorable in 1880 than it was in 1870. But in 1881 and 1882 the cost of all food was much enhanced, without a corresponding increase in wages.

The increase in the value of manufactures, from 1870 to 1880, was much greater than that in the number of operatives. The value of all manufactured products in 1870 was (in gold) $3,385,860,329, or $1668 per hand; in 1880 the value was $5,369,579,191, or $1923 per hand. The relative cost of the materials used differs in the various manufactures. In some it constitutes the chief item in the cost of production; in others it is relatively small, the chief expense being wages paid out. Taking all manufactures together, the cost of materials in 1870 was 59 per cent. of the value of the product; in 1880 the cost of the material was 63 per cent. of the value of the product. The wages paid out in 1870 formed 18.3 per cent. of the value of the product; in 1880 they formed 17.7 per cent. Thus, in 1870 the manufacturer paid out for material and wages 77.3 per cent., leaving 22.7 per cent. for interest upon capital and profits. In 1880 he paid out 80.7 per cent. for material and wages, retaining 19.3 per cent. for interest and profits. The increase in capital invested was very large. In 1870 the total capital invested in 252,148 manufacturing establishments was (in gold) $1,684,567,015; an average of about $6650 for each. In 1882 there was invested, in 253,852 establishments, a capital of $2,790,272,606; an average of about $11,000 for each. Thus, capital invested in manufactures returned considerably less percentage of profit in 1880 than it did in 1870, although so great was the increase in the value of the products, that the total of manufacturers' profits was very much greater in 1880 than in 1870.

There is a wide difference in the rates of wages earned by operatives in the various manufacturing industries. This arises from many causes, the one of most importance being the amount of skill required from the operative. In every industry the highest skill demands and receives the highest wages; while in nearly all there are many persons employed whose work and wages are only those of the common "laborer." The average rate of wages is also less in those industries where women and children form a considerable portion of those employed; for they invariably receive less wages than those paid to men, and the low wages paid to these reduces the general average. In many industries, also, the work is carried on during only a part of the year.

In the full and elaborate Tables comprised in the Census Report, 320 manufacturing industries are specified, with the number of establishments in which they are carried on. These establishments included (with certain exceptions) "every one in which mechanical or manufacturing industry was returned as having had during the Census year a product of five hundred dollars or more in value." These exceptions are: Fishing-products, quartz-milling, petroleum-refining, gas-making, and manufacturing by steam railroad companies. In regard to these statistics, the Superintendent of the Census says:

"The fact that—in the face of a large increase in the number of hands employed in manufactures, of the amount of material consumed, and of the values of the products—the *number of establishments* shows hardly an appreciable gain from 1870 to 1880, notwithstanding an increase of 30 per cent. in population, is amply accounted for by the well-known tendency to the concentration of labor and capital in large establishments. A very good example of the effect of this cause is found in the cooper trade, where, with a reduction in the number of establishments from 4961 to 3898 (or nearly 22 per cent.), the hands employed have increased 11 per cent.

"This cause has not, however, operated equally to produce a proportional reduction in all branches of industry. Thus, in the carpenter trade we have the average number of hands employed, 5.9 in 1880 against 3.9 in 1870. But this increase in the average number of hands does not alone explain the decrease in the number of establishments. We have also to take into account the effect of the growth of the sash, door, and blind factories, doing on a large scale, and by the aid of machinery, what was formerly done slowly on the spot by the individual carpenter. We have then to take into account the growth of the wheelwright trade. In 1870 there were 3613 establishments, employing an aggregate of 6989 hands; in 1880 there were 10,701 establishments, employing 16,108 hands. We have next to take into account the introduction of machinery into the furniture and cabinet-making industry, replacing much of the former work of the local carpenter in rural districts and small towns.

"We have to consider the immense extension of the contract-system of erecting buildings, the effect of which is to disconnect an increasing proportion of the working carpenters of every city or large town from actual shops, and

CARVED DECORATIVE PANEL.

COLUMBUS BEFORE THE COUNCIL.

See Note 20.

constitute them a movable, readily disposable force, to be hired now by this contractor and now by that, according as jobs arise. We have last to consider the rapid substitution of brick and stone for building, evidenced by the fact that the number of persons employed in the manufacture of brick in the United States has increased more than 50 per cent. in ten years.

"In the same way, while the cross-road's blacksmith-shop is still a necessity for tens of thousands of localities, very much of the work formerly done by the blacksmiths is now done on a larger scale by wheelwrights, locksmiths, or machinists, or in hardware factories or establishments producing numerous specialties in iron and steel. . . . Space will not allow us to take up trade after trade to indicate the conditions which have affected its rate of growth during the decade just passed, but the foregoing will serve to show the variety and the nicety of the considerations which require to be taken into account in this connection."

Although in the Census Report 320 manufacturing and mechanical industries are specified, yet more than seven-eighths of all the workmen are engaged in about fifty of these. Table XXVI. presents a general view of the most important features of these chief industries, including all of those in which more than 10,000 hands are employed. It shows, for each industry, the number of establishments, the number of hands employed, whether men, women, or children, the value of all the products, the total amount of wages paid during the census year (June, 1879, to June, 1880), and the average yearly amount for each hand.

It will be observed that, in those industries in which any considerable proportion of women and children are employed, the rate of wages falls much below the general average of $346. Thus, in the manufacture of men's clothing, women and children form 52 per cent. of the hands, and the average of yearly wages is $286. In women's clothing, women and children form 90 per cent., and the average of wages is $264. In cotton goods, women and children form 65 per cent., and the average of wages is $246. In woollen goods, women and children form 46 per cent., and the average of wages is $299. In hosiery and knit-goods, women and children form 74 per cent., and the average of wages is $232. In silk manufactures, women and children form 70 per cent., and the average of wages is $290. In shirt-making, women and children form 92 per cent., and the average

TABLE XXVI.—WORKERS AND THEIR WAGES. 1880.

Industries.	Establishments.	Workers.				Value of Products.	Wages during Year.	Average Yearly Wages.
		Men.	Women.	Children.	Total.			
	No.	No.	No.	No.	No.	Dollars.	Dollars.	Dollars.
Agr'l implements..	1,943	38,313	73	1,194	39,580	68,640,486	15,359,610	388
Blacksmiths.......	28,101	33,992	18	516	34,526	43,774,271	11,126,001	322
Bookbinding......	588	5,127	4,831	654	10,612	11,976,764	3,927,349	369
Boots and shoes...	17,972	104,021	25,946	3,852	133,819	196,920,481	50,995,144	381
Bread, etc.........	6,396	18,925	2,210	1,353	22,488	65,824,896	9,411,328	419
Brick and tile.....	5,631	59,032	268	7,055	66,355	32,833,587	13,443,532	202
Car-building.......	130	13,885	13	334	14,232	27,997,591	5,507,753	387
Carpenters........	9,184	53,547	74	517	54,138	94,152,139	24,582,077	454
Carpets...........	195	10,104	8,570	1,697	20,371	31,792,802	6,835,218	325
Carriages & wagons	3,841	43,630	273	1,491	45,394	64,951,617	18,988,615	419
Clothing, men's....	6,166	77,255	80,994	2,564	160,813	209,548,460	45,940,353	286
Clothing, women's..	562	2,594	22,253	345	25,192	32,004,794	6,661,005	264
Cooperage.......	3,898	24,435	42	1,496	25,973	33,714,770	8,992,603	342
Cotton goods......	1,005	64,107	91,148	30,217	185,472	210,950,383	45,614,419	246
Dyeing, etc........	191	12,788	2,038	1,872	16,698	32,297,420	6,474,364	388
Fertilizers........	364	14,677	75	146	14,898	23,650,795	2,648,422	178
Flour, etc.........	24,388	58,239	42	126	58,407	505,185,712	17,422,316	315
Foundery, etc......	4,958	140,459	675	4,217	145,351	214,378,468	65,982,133	454
Fruits, canned.....	411	10,638	15,463	5,804	31,905	17,599,576	2,679,960	84
Furniture.........	4,843	45,186	917	2,626	48,729	68,037,902	20,383,794	418
Glass............	211	17,778	741	5,658	24,177	21,154,571	9,144,100	378
Hardware.........	492	14,481	814	1,506	16,801	22,653,693	6,846,693	408
Hats and caps.....	480	11,373	5,337	530	17,240	21,303,107	6,635,522	385
Hosiery, etc.......	359	7,517	17,707	3,661	28,885	29,167,227	6,701,475	232
Iron and steel.....	1,005	133,203	45	7,730	140,978	296,557,685	55,476,785	393
Jewellery.........	739	10,050	1,998	649	12,697	22,201,621	6,441,688	500
Leather, dressed...	2,521	15,774	285	389	16,448	86,750,608	7,286,785	443
Leather, tanned....	3,105	23,287	188	337	23,812	113,348,336	9,204,243	386
Liquors, malt......	2,191	26,001	29	190	26,620	101,058,385	12,198,053	465
Lumber, planed ...	1,203	14,614	23	652	15,289	36,803,350	5,890,724	385
Lumber, sawed	25,708	141,564	425	5,967	147,956	233,268,729	31,845,974	215
Marble and stone..	2,846	21,112	23	336	21,471	31,415,150	10,238,885	477
Masonry..........	1,591	15,877	1	142	16,020	20,586,553	6,880,866	430
Mixed Textiles	470	17,471	20,520	5,382	43,373	66,221,703	13,316,753	307
Musical instruments	429	10,905	176	250	11,331	19,254,739	7,098,794	627
Painting, etc.......	3,968	17,271	131	309	17,711	22,457,560	7,920,886	447
Paper............	692	16,133	7,640	649	24,422	55,109,914	8,525,355	349
Plumbing, etc......	2,161	9,217	15	452	9,684	18,133,250	4,770,389	493
Printing, etc.......	3,634	49,521	7,067	6,212	62,800	97,701,679	32,838,959	521
Saddlery..........	7,999	20,024	561	861	21,446	38,081,643	7,997,752	370
Sashes, doors, etc...	1,288	20,544	79	1,275	21,898	36,621,325	8,540,930	390
Sewing-machines...	124	10,168	248	959	11,375	15,928,025	5,319,437	468
Ship-building......	2,188	21,338	......	7	21,345	36,800,327	12,713,813	600
Shirts............	549	2,878	22,186	623	25,687	20,130,031	5,403,696	210
Silk goods........	382	9,375	16,396	5,566	31,337	41,033,045	9,146,705	290
Slaughtering......	872	26,113	......	1,184	27,297	303,562,413	10,508,530	385
Tin-ware, etc.	7,595	23,903	853	1,492	25,348	48,096,038	10,722,974	423
Tobacco, chew'g, etc.	477	14,886	10,776	7,094	32,756	52,793,056	6,419,024	196
Tobacco, cigars	7,145	40,099	9,108	4,090	53,297	63,979,575	18,464,562	345
Wheelwright......	10,701	15,821	17	270	16,108	18,892,858	5,074,799	377
Wire-work........	345	9,139	472	1,017	10,628	19,964,426	3,690,896	348
Wooden-wares.....	997	9,201	275	1,222	10,698	11,905,593	3,688,485	345
Woollen goods....	1,990	46,978	29,372	10,154	86,504	160,606,721	25,836,392	299
Worsted goods....	76	6,435	9,473	2,895	18,803	33,549,942	5,683,027	302

of wages is $210. In the manufacture of chewing and smoking tobacco, women and children form 60 per cent., and of these fully one-third are children, and the average of wages is $196.

The question of the effect of the employment of women and children, to any noticeable extent, in any branch of industry, upon the general rates of wages in that branch, is deserving of consideration in several aspects. Upon the one hand it affords employment, more or less remunerative, to a large number of persons who most need it, and in this aspect it appears highly desirable; but on the other hand it certainly tends to lower the general rate of wages paid to all the persons engaged in those industries. While the women and children receive much less than appears in the general average, and the men, consequently, somewhat more than this average, it will yet be found that the wages of the men in these branches fall below the general average in similar industries. That is, the wages of male factory operatives are less than those of most other mechanics. There are, indeed, exceptions to the general rule. In all our large manufacturing establishments there are men of high skill in some departments who command very large salaries; and these are sufficiently numerous to furnish excellent openings for skilled industry.

In a number of industries in which men are chiefly employed the rate of wages falls much below the general average of all industries. For this several causes are to be assigned. In some branches the labor is mainly "unskilled," and the rates of wages do not differ materially from those paid to other "laborers." Thus, in flour and grist mills, in which the hands are almost wholly men, the average of wages is $315. In many cases, also, the work is carried on during only a portion of the year. Thus, in brickmaking, which is interrupted during the winter, the average of wages is only $202. In lumbering it is $215. The canning and preservation of fruits and vegetables is the most striking example of this class of occupations, since the season during which it can be carried on lasts only a few weeks, and the hands employed, of whom one-third are men, earn in this business only $84 a year. It is to be presumed that the men are busied in other occupations during the remaining months of the year. Those industries which are mainly carried on in-doors, and, consequently, are not greatly influenced by the state of the weather, show a marked gain in total wages over those of like character which are carried on out-of-doors, although in the latter the daily rate of wages is somewhat higher. Thus the average for carpenters is $454 a year, while that of stone-masons and bricklayers is $430. There are also several industries which are carried on to a considerable extent in rural localities which show a reduced rate of average wages. There will, for example, be a blacksmith and a saddler in almost every hamlet, who may not be occupied at his trade all the time. The average yearly earnings of a blacksmith are $322; of a saddler, $370. Very often these men are also farmers, and are sometimes returned in the Census Report as "blacksmith and farmer," or "saddler and farmer," etc. These and many other factors enter into the problem of determining the comparative advantages of the various branches of mechanical industry.

In cities the mechanic is usually occupied solely in his own trade, from which he derives his entire support, and in each city the rates of wages for each trade are very nearly uniform, although there is a wide difference in the several cities. The wages in cities are, as a rule, somewhat higher than in the country adjacent to them. Table XXVII. shows, for nine of the principal cities of the United States, the amount received as wages in twelve of the leading mechanical industries during the year 1880. The trades selected are those in which few or no women and children are employed, and, if any are employed, due

TABLE XXVII.—WAGES IN CITIES, FOR TRADES.

Trades.	Baltimore.	Boston.	Chicago.	Cincinnati.	New Orleans.	New York.	Philadelphia.	St. Louis.	S. Francisco.
Bakers	$418	$455	$510	$395	$366	$433	$418	$462	$690
Blacksmiths	455	484	587	490	479	652	480	548	654
Carpenters	550	477	505	440	521	643	496	602	762
Foundery-men	505	542	495	490	540	542	482	537	655
Masons	407	438	470	432	393	605	444	535	707
Painters	533	446	530	362	310	597	396	448	636
Plumbers	433	504	546	389	563	580	415	520	515
Printers	595	640	603	467	679	606	490	583	851
Saddlers	446	410	450	400	498	527	402	452	490
Shipwrights	600	639	524	584	512	828	740	671	1127
Tinsmiths	463	490	490	412	470	490	447	415	608
Wheelwrights	365	453	490	406	300	571	456	424	661

allowance has been made. The table, therefore, shows the number of dollars earned by men.

Table XXVIII. will afford material aid to the student of industrial development, and will be extremely valuable to all who contemplate embarking in manufacturing enterprises. It will, in fact, repay the careful study of any person.

Interest on money invested, taxes, wear of machinery, etc., etc., must be deducted from the profits named in this table. The investigator can ascertain most of these items in various ways, and draw conclusions for himself.

TABLE XXVIII.—MANUFACTURING ESTABLISHMENTS, CAPITAL, AND PROFIT.

Manufactures.	Establishments.	Capital.	Profit.
	Number.	*Dollars.*	*Per Cent.*
Agricultural implements	1,943	62,109,668	.35
Ammunition	4	824,000	.38
Artificial feathers and flowers	174	1,253,050	1.08
Artificial limbs	33	82,600	.74
Awnings and tents	151	527,700	.79
Axle-grease	16	372,600	.30
Babbitt metal and solder	9	73,100	.41
Bagging flax, hemp, and jute	27	2,491,500	.25
Bags, other than paper	37	2,425,900	.38
Bags, paper	80	1,304,700	.48
Baking and yeast powders	110	1,350,600	.71
Baskets, rattan and willow-ware	304	1,852,917	.21
Bellows	3	8,750	.72
Bells	20	793,120	.32
Belting and hose, leather	96	2,748,799	.32
Belting and hose, linen	1	10,000	.65
Belting and hose, rubber	2	265,000	.34
Billiard-tables and materials	46	1,078,169	.74
Blacking	48	494,625	1.25
Blacksmithing	28,101	19,618,852	.92
Blueing	23	178,650	.54
Bone, ivory, and lamp-black	18	627,350	.22
Bookbinding and blank-book making	588	5,798,071	.49
Boot and shoe cut stock	172	1,210,300	.70
Boot and shoe findings	135	770,800	.65
Boot and shoe uppers	81	209,264	.82
Boots and shoes, including custom and repairing	17,972	54,358,301	.56
Boots and shoes, rubber	9	2,425,000	.91
Boxes, cigar	221	1,023,777	.84
Boxes, fancy paper	369	2,496,496	.68
Boxes, wooden, packing	602	5,304,212	.42
Brass and copper, rolled	26	9,057,600	.25
Brass castings	396	5,740,237	.38
Brassware	20	594,582	.27
Bread and other bakery products	6,396	19,155,286	.72
Brick and tile	5,631	27,673,616	.34
Bridges	75	4,058,649	.35
Bronze castings	7	186,500	.58
Brooms and brushes	980	4,186,897	.58
Buttons	124	2,013,350	.50
Calcium lights	4	19,500	.79

Manufactures.	Establishments.	Capital.	Profit.
	Number.	*Dollars.*	*Per Cent.*
Card-board	8	443,000	.46
Card-cutting and designing	9	13,793	1.29
Carpentering	9,184	19,541,358	.91
Carpets other than rag	195	21,468,587	.27
Carpets, rag	396	252,604	.97
Carpets, wool	5	41,600	1.32
Carriage and wagon materials	412	7.034,718	.36
Carriages and sleds, children's	67	770,000	.45
Carriages and wagons	3,841	37,973,493	.40
Cars, railroad, street, and repairs, not including statistics of establishments operated by steam railroad companies	130	9,272,680	.29
Celluloid and celluloid goods	6	1,214,000	.51
Charcoal	175	457,484	.57
Cheese and butter (factory)	3,932	9,604,803	.60
Chocolate	7	530,500	.76
Cigar-moulds	3	69,800	.35
Cleansing and polishing preparations	21	412,325	.41
Clock-cases and materials	2	6,000	2.75
Clocks	22	2,474,900	.35
Cloth finishing	20	137,350	.63
Clothing, horse	3	410,000	.25
Clothing, men's	6,166	79,861,696	.43
Clothing, women's	562	8,207,273	.70
Coal-tar	3	385,000	.30
Coffee and spices, roasted and ground	300	6,366,392	.52
Coffins, burial-cases, and undertaker's goods	769	5,735,392	.43
Coke	149	5,545,058	.11
Collars and cuffs, paper	13	901,233	.29
Combs	38	533,390	.44
Confectionery	1,450	8,486,874	.50
Cooperage	3,898	12,178,726	.51
Coppersmithing	98	915,102	.37
Cordage and twine	165	7,140,475	.22
Cordials and sirups	16	128,400	.60
Cork-cutting	46	872,384	.40
Corsets	113	1,611,695	.65
Cotton-compressing	29	3,243,800	.11
Cotton goods	1,005	219,504,794	.23
Cotton ties	6	70,500	.76
Crucibles	11	1,450,250	.14
Cutlery and edge-tools	429	9,859,885	.25
Dentistry, mechanical	75	773,650	1.48
Dentist's materials	20	840,800	.44
Drain and sewer pipe	51	489,163	.51
Drugs and chemicals	592	28,598,458	.33
Dyeing and cleaning	303	851,110	.66
Dyeing and finishing textiles	191	26,223,981	.46
Dyestuffs and extracts	41	2,363,700	.34
Electric lights	3	425,000	.44
Electrical apparatus and supplies	36	873,300	.56
Electro-plating	221	865,898	.79
Emery-wheels	11	397,900	.38
Enamelled goods	3	150,000	.28
Enamelling	19	145,200	.38
Engravers' materials	11	54,500	.30
Engraving and die-sinking	246	416,840	1.19
Engraving, steel	55	2,387,050	.16
Engraving, wood	167	183,733	1.80
Envelopes	12	923,800	.33
Explosives and fire-works	39	579,750	.57
Fancy articles	151	1,359,450	.52
Felt goods	26	1,958,254	.38

Manufactures.	Establishments.	Capital.	Profit.
	Number.	*Dollars.*	*Per Cent.*
Fertilizers	364	17,913,660	.31
Files	179	1,666,550	.44
Fire-arms	39	8,115,489	.14
Fire-extinguishers, chemical	3	400,000	.09
Flags and banners	11	54,300	.81
Flavoring extracts	58	404,615	.66
Flax, dressed	79	620,455	.36
Flour and grist mill products	24,338	177,361,878	.26
Food preparations	109	1,293,905	.44
Foundery and machine-shop products	4,958	154,519,484	.29
Foundery supplies	15	126,500	.44
Fruit-jar trimmings	1	150,000	.41
Fruits and vegetables, canned and preserved	411	8,247,488	.34
Fuel, artificial	1	100,000	.37
Furnishing goods, men's	161	3,724,664	.63
Furniture	4,843	38,669,764	.41
Furniture, chairs	384	6,276,364	.32
Furs, dressed	192	3,598,887	.41
Galvanizing	21	671,450	.79
Gas and lamp fixtures	35	3,248,400	.36
Gas machines and meters	34	1,147,000	.26
Glass	211	19,844,699	.20
Glass, cut, stained, and ornamented	170	945,180	.70
Gloves and mittens	300	3,379,648	.40
Glucose	7	2,255,000	.39
Glue	82	3,916,750	.23
Gold and silver leaf and foil	60	498,500	.38
Gold and silver, reduced and refined, not from the ore	28	817,100	.29
Graphite	4	113,000	.27
Grease and tallow	156	2,566,779	.54
Grindstones	14	125,261	.33
Gunpowder	33	4,983,560	.15
Hair-work	299	613,040	.77
Hammocks	5	22,300	1.38
Handles, wooden	206	1,032,090	.50
Hard knit goods	39	152,700	.45
Hard stamps	46	103,150	1.28
Hardware	492	15,363,551	.37
Hardware, saddlery	64	1,655,550	.56
Hat and cap materials	64	746,828	.57
Hats and caps, not including wool hats	489	5,455,468	.97
High explosives	21	1,601,625	.66
Hones and whetstones	25	132,525	.59
Hooks and eyes	5	420,188	.15
Hosiery and knit goods	359	15,579,591	.46
House-furnishing goods	48	456,806	.64
Ice, artificial	35	1,251,200	.19
Ink	63	1,251,050	.42
Instruments, professional and scientific	171	1,342,196	.45
Iron and steel	1,005	230,971,884	.21
Iron bolts, nuts, washers, and rivets	100	4,933,019	.40
Iron doors and shutters	6	79,375	1.19
Iron forgings	91	3,598,241	.33
Iron nails and spikes, cut and wrought	62	3,877,805	.27
Iron pipe, wrought	35	6,129,565	.33
Iron railing, wrought	131	662,197	.47
Iron-work, architectural and ornamental	89	738,000	.74
Ivory and bone-work	55	775,564	.36
Japanning	30	78,710	.77
Jewellery	739	11,431,164	.47
Jewellery and instrument cases	17	62,000	.51
Jute and jute goods	4	415,000	.26

Manufactures.	Establishments.	Capital.	Profit.
	Number.	*Dollars.*	*Per Cent.*
Kaoline and ground earths	63	1,291,527	.34
Kindling-wood	213	1,018,490	.54
Labels and tags	19	451,500	.49
Lamps and reflectors	74	1,873,625	.40
Lapidary work	55	176,875	.98
Lard, refined	26	2,513,066	.27
Lasts	62	477,692	.49
Lead, bar, pipe, sheet, and shot	32	2,466,375	.37
Leather, board	24	856,200	.19
Leather, curried	2,319	16,878,520	.42
Leather, dressed skins	202	6,266,237	.32
Leather goods	57	561,900	.82
Leather, patent and enamelled	2	17,100	5.14
Leather, tanned	3,105	50,222,054	.36
Lightning-rods	20	431,750	.46
Lime and cement	615	6,332,338	.24
Linen goods	5	406,800	.23
Liquors, distilled	844	24,247,595	.43
Liquors, malt	2,191	91,208,224	.56
Liquors, vinous	117	2,581,910	.23
Lithographing	167	4,501,825	.41
Lock and gunsmithing	607	705,815	.77
Looking-glass and picture frames	645	4,437,666	.51
Lumber, planed	1,203	17,612,923	.36
Lumber, sawed	25,708	181,186,122	.30
Malt	216	14,390,441	.24
Mantels, slate, marble, and marbleized	46	750,300	.32
Marble and stone work	2,846	16,498,221	.51
Masonry, brick and stone	1,591	3,990,706	.89
Matches	37	2,114,850	.39
Mats and matting	12	212,000	.37
Mattresses and spring-beds	357	1,749,750	.74
Millinery and lace goods	247	2,678,880	.66
Millstones	16	178,900	.48
Mineral and soda waters	512	2,569,561	.60
Mirrors	7	155,800	.30
Mixed textiles	470	37,996,057	.41
Models and patterns	230	377,551	.92
Mucilage and paste	4	3,100	1.50
Musical instruments, and materials not specified.	84	654,850	.26
Musical instruments, organs, and materials	171	3,922,338	.33
Musical instruments, pianos, and materials	174	9,869,577	.23
Needles and pins	40	1,144,550	.34
Nets and seines	13	140,650	.40
Oil, castor	8	474,000	.47
Oil, cotton-seed, and oil-cake	45	3,862,300	.44
Oil, essential	124	67,755	1.46
Oil, illuminating, not including petroleum refining	7	128,500	.57
Oil, lard	28	1,127,500	.33
Oil, linseed	81	5,872,750	.29
Oil, lubricating	51	1,370,225	.42
Oil, neat's-foot	15	433,050	.07
Oil, resin	3	82,523	.41
Oil-cloth, enamelled	4	315,000	.25
Oil-cloth, floor	25	3,429,550	.26
Oleomargarine	15	1,680,300	.70
Painting and paper-hanging	3,968	5,645,950	1.02
Paints	244	13,555,292	.39
Paper, not specified	692	46,241,202	.27
Paper-hangings	25	3,560,500	.49
Paper patterns	4	105,100	4.07
Patent medicines and compounds	563	10,620,880	.47

Manufactures.	Establishments.	Capital.	Profit.
	Number.	*Dollars.*	*Per Cent.*
Paving materials	46	745,750	.27
Pencils, lead	4	341,597	.23
Pens, gold	16	370,150	.45
Pens, steel	3	182,500	.20
Perfumery and cosmetics	67	813,827	.93
Photographic apparatus	10	90,800	.24
Photographing	1,287	3,131,895	.80
Photographing materials	5	63,000	.26
Pickles, preserves, and sauce	109	841,033	.80
Pipes, tobacco	37	233,800	.79
Plated and Britannia ware	55	5,862,025	.34
Plumbing and gas-fitting	2,161	5,950,512	.71
Pocket-books	53	598,350	.59
Postal cards	1	20,000	..
Printing and publishing	3,467	62,983,704	.44
Printing materials	27	199,900	.66
Pumps, not including steam-pumps	411	2,383,482	.39
Racking hose	1	500	5.92
Refrigerators	71	727,220	.59
Regalia, and society banners and emblems	47	452,590	.46
Registers, car-fare	1	300,000	*
Rice, cleaning and polishing	22	562,200	.63
Roofing and roofing materials	493	2,329,277	.61
Rubber and elastic goods	90	6,057,987	.36
Rubber, vulcanized	3	226,200	.97
Rules, ivory and wood	6	54,200	.55
Saddlery and harness	7,999	16,508,019	.61
Safes, doors and vaults, fire-proof	40	2,201,600	.37
Salt	268	8,225,740	.18
Salt, ground	8	322,900	.11
Sand and emery paper and cloth	6	121,500	.68
Sashes, doors, and blinds	1,228	20,457,670	.35
Saws	89	3,281,135	.29
Scales and balances	64	3,814,981	.47
Screws	20	4,265,000	.18
Sewing-machine cases	18	741,300	.19
Sewing-machines and attachments	106	12,501,830	.35
Shingles, split	45	17,770	.90
Ship-building	2,188	20,979,874	.27
Shirts	549	6,841,778	.49
Shoddy	73	1,165,100	.69
Show-cases	93	341,970	.94
Silk and silk goods	382	19,125,300	.49
Silversmithing	38	257,198	.33
Silverware	39	1,640,900	.33
Slaughtering and meat-packing, not including retail butchering establishments	872	49,419,213	.51
Smelting and refining base scrap-metal, not from the ore	4	162,100	.49
Soap and candles	629	14,541,294	.30
Soda-water apparatus	8	413,000	.82
Spectacles and eye-glasses	62	643,825	.48
Sporting goods	86	1,444,750	.31
Springs, steel, car, and carriage	59	1,769,293	.34
Stamped ware	26	2,175,940	.75
Starch	139	5,328,256	.39
Stationery goods	159	3,286,325	.37
Steam fittings and heating apparatus	95	3,075,751	.31
Stencils and brands	104	224,525	.83
Stereotyping and electrotyping	45	536,000	.39
Stone and earthenware	686	6,380,610	.32

* Less than one per cent.

Manufactures.	Establishments.	Capital.	Profit.
	Number.	*Dollars.*	*Per Cent.*
Straw goods	77	3,333,560	.40
Sugar and molasses, beet	4	365,000	.09
Sugar and molasses, refined	49	27,432,500	.28
Surgical appliances	71	843,142	.53
Tar and turpentine, not including farm products.	508	1,866,390	1.03
Taxidermy	16	25,750	1.50
Telegraph and telephone apparatus	40	636,458	.57
Terra-cotta ware	15	496,550	.36
Thread, linen	1	500,000	.38
Tin-foil	4	686,000	.17
Tin-ware, copper-ware, and sheet-iron ware	7,595	22,252,290	.54
Tobacco, chewing and smoking, and snuff	477	17,207,401	.69
Tobacco, cigars and cigarettes	7,145	21,698,549	.73
Tobacco-stemming	52	1,089,342	.29
Tools	145	4,384,109	.27
Toys and games	106	915,575	.49
Trunks and valises	265	2,792,256	.55
Type-founding	48	2,772,690	.25
Umbrellas and canes	172	2,658,725	.47
Upholstering	781	2,885,401	.57
Upholstering materials	79	1,690,200	.11
Varnish	81	3,778,100	.43
Vault light and ventilators	12	138,450	.70
Veneering	5	261,500	.46
Vinegar	306	2,151,766	.51
Washing-machines and clothes-wringers	61	652,549	.64
Watch and clock materials	20	117,550	.70
Watch and clock repairing	1,202	1,704,571	.63
Watch-cases	27	1,584,740	.50
Watches	11	4,144,327	.13
Whalebone and rattan	12	166,450	.48
Wheelbarrows	22	266,200	.19
Wheelwrighting	10,701	10,641,080	.66
Whips	88	1,078,070	.54
Windmills	69	697,100	.34
Window blinds and shades	131	1,385,515	.59
Wire	40	4,230,071	.42
Wire-work	305	3,681,893	.54
Wood-preserving	2	120,000	.18
Wood pulp	50	1,898,450	.49
Wood, turned and carved	710	3,450,710	.48
Woodenware	287	3,696,794	.29
Wool hats	43	3,615,830	.58
Woollen goods	1,990	96,095,564	.35
Worsted goods	76	20,374,043	.28
Zinc	16	2,022,600	.14

CHAPTER XXVI.

REQUISITES FOR SUCCESS IN MECHANICAL ARTS.

THE various mechanical industries present numerous opportunities for the acquisition of an honorable competence, and even of wealth. In most other avocations the possession of a considerable capital is an absolute prerequisite. The merchant must have capital, or credit—which is practically the same thing—to start with. The farmer usually owns his land and live-stock, and must have various implements and machinery, often expensive. The lawyer or physician must have at least the capital which has been permanently invested in his support during the years while he was studying for his profession; and, after he is ready to enter upon the practice of it, he must, in most cases, wait for several years before he can earn a good income, even if he is in the end successful.

The mechanic or craftsman is, in a great measure, free from these initiatory burdens. His earnings commence from the day when his apprenticeship begins, and from the first he usually receives his full support. In several States—New York among the rest—there is upon the statute-books an admirable law of apprenticeship. The indenture must be signed by the employer, by the apprentice, and by his parents or guardians. The apprentice must engage to serve for not less than three nor more than five years; if he leave his master without due cause he may be arrested and put in prison. The master must covenant to provide the apprentice with proper food, lodging, and medical attendance, to teach him every branch of the craft, and at the end of the term to give him a written certificate that he has served his full time. This indenture of apprenticeship is by law held to have something of the sacredness of the marriage-contract, for it cannot be invalidated even by mutual consent, but requires an order from some proper court.

Such formal indentures of apprenticeship are not now usual. The master is not held bound to make a thorough workman of his apprentice, who may learn about as much or as little of the craft as he pleases. It may very reasonably be questioned whether the former method of apprenticeship was not better than the present one. But, in any case, the young man who expects to succeed must make up his mind from the outset to see how much of his trade he can master—not how little. The difference between an unskilled workman and a thoroughly skilled one makes all the difference between success and failure; and between a great failure and a high success there is every gradation of partial failure and moderate success.

The artisan may earn journeyman's wages from the time when he enters upon earliest manhood. He can exercise his craft wherever he pleases, without let or hinderance. The cumbrous system of "guilds," which in Europe so terribly hampers the craftsman under pretence of aiding and protecting him, has hardly even a nominal place among us; for our "trades-unions" are, in their intent, only voluntary associations for mutual convenience into which any respectable member of the craft may enter as a matter of right. There is nothing to prevent any man—or woman, for that—from learning any trade and from working at it whenever he pleases. And he can do this without any capital except his own educated hand—the only fitting implement for executing the purposes and behests of the educated brain. The education of the hand to fulfil its uses is of paramount importance to the artisan.

It is the hand quite as truly as the brain which distinguishes the human being from all other creatures; and the hand can be educated not less than the brain can be. Man alone has a developed hand. The paw of the monkey is not a hand. It has, indeed, four fingers and a thumb—such as they are—and so the monkey is capable of grasping an object with either of his four paws. The position of the thumb, and its great strength, is the main characteristic of the human hand as distinguished from the paw of the chimpanzee, which differs less from our hand than that of any other of the monkey tribes. The thumb of the chimpanzee is feeble, and reaches only as far as the root of the fingers. In man the thumb reaches to the second joint of the fingers, and is as strong as all of them together. Upon the position of the thumb in relation to the fingers, its length, strength, and freedom of movement, depends mainly the adaptation of the human hand to be the sceptre of the world. Apart from his hand man is, in proportion to his size and weight, one of the weakest and most defenceless of earthly creatures. With the exception of the sense of touch, of which the hand is the special organ, he is exceeded in the acuteness of his physical sense by many beasts and birds. The eagle and hawk and all the feline animals surpass him in sharpness of sight, the dog and the hyena in keenness of smell, and most wild beasts in acuteness of hearing.

Without a hand such as he has, man could never have attained his ascendency over the animate and inanimate world; and were he to be deprived of it he could not maintain this supremacy. Without the hand he could never have constructed tools for use or weapons for defence and offence, and could not use them if they were furnished to him. Some philosophers have gone so far as to maintain that man's supremacy is owing to his possession of a hand; but this is only a partially true, and, therefore, a wholly untrue, representation of the case. The hand is not the cause of man's superiority, but the means by which he is able to assert it. His supremacy lies primarily in his brain—using the word to include the whole of that complex organization through which the intangible mind acts upon tangible matter.

Give a lion—he having only a lion's brain—a pair of human hands, and he would still be a lion and nothing more. He would never build a house or dig a well, fashion a spear or paint a picture. The physical organs of all animals are quite adequate for the doing of many things which would greatly contribute to their comfort—things which they never do, because they have not the necessary directing brain. The bear needs a burrow as well as the rabbit, and his paws are equally adapted to the digging of one; but he never does this, and trusts to chance for a cave. He has the paw, but lacks the brain.

The paw of the chimpanzee is capable of performing many important functions of the human hand. Had he the necessary brain he could rub two sticks together and create a blaze, and gather fuel to keep the fire alive. But no ape or monkey has ever thought of building or maintaining a fire for himself. If he comes upon one which a hunter has left smouldering, he will crouch by the embers as long as they are warm, but it never occurs to him to put fresh fuel upon the fire, and so keep it burning. The paw of the orang-outang is perfectly adapted for wielding a club or hurling a stone; but—Cuvier to the contrary notwithstanding—there is no good reason to believe that any monkey, unless taught by man, has ever employed any such means of offence or defence, or has ever used any kind of tool or implement except those with which Nature has furnished him. Man has not inaptly been designated, in contradistinction from all other creatures, as a "tool-using animal." There is no human race, however low, which does not make and use tools of some kind; there is no other animal, however high in the scale, which of itself either makes or uses them. Give a being a human hand and a monkey's brain and he would never be capable of doing what man does. Give a being a human brain and a monkey's hand and he would do many things which the monkey never does. But it is not until you give a being both a human brain and a human hand that this being becomes a man.

The hand derives its value as an instrument for man's use, from the fact that it is capable of executing so many things which the brain conceives—things which practically transform him from one of the weakest and most defenceless of creatures to the strongest of them all. "Some animals," says Ray, "have horns, some have hoofs; some have teeth; some have claws, spurs, and beaks. Man hath none of these; but a hand—with reason to use it—supplies the use of all these."

We speak of the "education of the hand;" and the hand, as the special organ of the sense of touch, is capable of being "educated" in a manner—or, at least, to an extent—far higher than can be done with any other of the organs of sense. The eye of a child a few months old sees as well, his ear hears as well, as they do in mature life. What we call the education of the eye and the ear is rather the training which the mind gives itself in order to correctly interpret what the eye or the ear reports to it. The education of the hand involves all this, and much more; for the eye and the ear are mainly the informants of the mind, while the hand, besides this, is also the apt instrument for carrying out the intentions of the will, and for this purpose it must receive the most sedulous training.

The eye and the ear act only very slightly under the direction of the will. If they are open, the will cannot prescribe what they shall see or hear. But the hand acts only when and in what manner the will directs. The will orders a blow to be struck, and the hand strikes; a web to be woven, and the hand weaves; a picture to be painted, and the hand paints; a tune to be played, and the hand touches the responsive keys.

So thoroughly may the hand be trained that it seems to do its work automatically. The musician wills that a certain note be given out from the piano or organ, and the hand flies, apparently of itself, to the proper place on the key-board; the proper finger and no other not only strikes the right key, but with the right force and duration. The printer wishes to pick up a particular letter which forms a part of the word which he is to "set up." His eye shows him a hundred boxes in his "case," in each of which are hundreds of types lying in all positions, and selects one which happens so to lie that it can be picked up and brought to the "stick," right end upward and right side outward, without turning it on the way. The will and the eye have apparently nothing further to do in the matter. The right hand goes to the proper box, the fingers close upon the selected type and bring it to its place in the "stick," and all in a second or less. The left hand, and each finger of it, are no less busy in holding the "stick," shifting its place in the hand, and keeping the line of types in position. The mind and the eye are meanwhile busied in spelling out the words of the "copy" which is to be "set up," letter by letter. But, no sooner is one type deposited in its place than the mind is ready to order another to be picked up, and so on hour after hour.

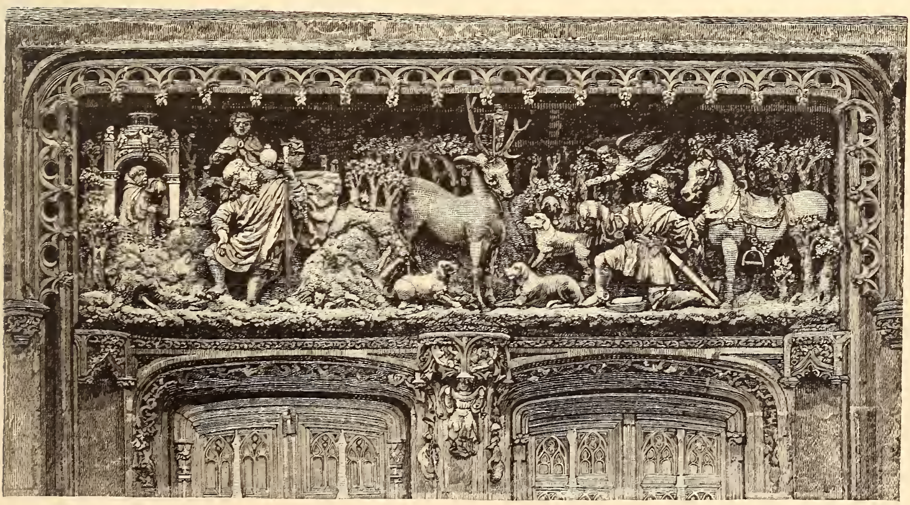
The process of "distributing" the types is quite as remarkable as that of "composing" them, and is performed five or six times as rapidly. The left hand of the compositor holds some twenty lines of "matter" — that is, types which, having been printed from, are to be replaced in the "case." Of this he takes as many as he can conveniently hold between the balls of the thumb and forefinger of the right hand, holds the word before the eye so that he can read it, and then begins to drop the letters, each into its own box. The hand hovers over the case like a bee upon the wing, without a moment's pause except to take new matter. A good compositor will, in this manner, distribute from 10,000 to 20,000 types in an hour, making scarcely an error. "Clean distributing" is one of the most essential points of a good compositor, for every error which he makes in distributing will, of necessity, appear in the composition, and must be corrected by him. A slovenly compositor may spend half his time in correcting errors which a clean compositor would not have made.

The operation of type-setting presents a favorable illustration of the perfection to which the education of the hand may be brought. But the principle—and sometimes even to a higher degree—extends to every department of mechanical industry. In this instance the hand works most of the time independently of the eye, which loses sight of the hand the instant the fingers have closed upon the type. But there are cases in which the best-educated hand can do its work only with the co-operation of the eye and under its constant supervision. The watchmaker's eye must never for an instant lose sight of his fingers. The hand of the engraver can cut the delicate lines upon his block or plate only under the superintendence of the eye; and the variation of a fraction of a hair's-breadth might mar the effect of the whole work.

The hand differs from the other organs of sense in this, that

"EVENING."

See Note 21.



SCULPTURE OVER DOOR OF ST. HUBERT'S.

See Note 22.

the pair forms two separate organs, acting independently of each other. The two eyes and the two ears, when in a normal condition, usually act as one organ and unite in performing a single act. In the duplex organ of vision the true report is not that of either eye, but is made up of the combined report of both. The true position of any object is not that in which it is seen by the right eye or by the left, but is midway between them.

The two hands forming, as it were, two individuals, must receive a separate education. The right hand may have been trained to do a thing perfectly, while the left hand cannot do it at all, or only very imperfectly. A man often writes beautifully with the right hand, while he can make only an illegible scrawl with the left. It is by no means agreed upon why most men are found to be right-handed, those who are left-handed or both-handed being exceptions to the general rule; but such is the fact. There seems to be nothing in the mechanism of the two hands and arms to account for this; and there is nothing which the right hand can do which the other may not be trained to do just as well. A child who has lost the use of his right hand can be taught to write just as well with the left. Many who have lost their right hands after reaching maturity have trained the left hand to write as well as the other ever could.

Not unfrequently both hands must be equally and simultaneously used in precisely the same work. The wood-chopper "shifts hands" from time to time, each hand doing by turns the work of the other. The accomplished organist or pianist uses both hands at the same time and with equal facility. The violinist uses both hands at the same time, but in a different manner; but it is not easy to say whether the "bowing" or the "fingering" calls for the more technical skill. As a matter of fact, however, the left hand is in most cases much less efficient than the other and, as it has so much important work to do, there is all the more reason why its training should receive special attention. It is like a child whose early education has been neglected, and the deficiency should, as far as possible, be made up.

To a certain and not very limited extent the capacity of the hand for education is hereditary, like most other of our physical and mental characteristics. The child inherits in a measure the hands as well as the features of one or both of its parents, and the parents likewise inherit those of theirs. In the East, where the sons have followed the occupations of their fathers from time immemorial, the workmen produce marvels of manual skill, which we are wholly unable to equal. Not a little of this is to be attributed to the inherited as well as to the acquired dexterity of the hand.

The education of the hand is important in every sphere of industry. It is of special consequence in all "skilled labor." The wide difference between a first-rate artisan and an ordinary or inferior one depends very much upon the education which their respective hands have received. Without a well-educated hand no man can become a first-rate artisan or artist. This lacking, nothing else can supply the defect; and it must be borne in mind that in the education of the hand every one must be mainly his own constant instructor.

The difference between the earnings of a first-class and a second-class workman is very great. The first-class man will inevitably secure the best-paying work; and, moreover, which is of quite equal consequence, he may be sure of always having work to do. In the dullest of times he can hardly fail to be employed, while his less capable competitor is forced to sit idle. It is not a little surprising how small is the proportion of thoroughly competent workmen in any department of industry; and there are few branches in which there is likely to be an over-supply of such. In almost every department of endeavor there is, at least with us, "room at the top." It is far below the summit that overcrowding begins, and from thence downward it goes on, ever increasing, to the very bottom.

The bearing of this education of the hand upon the artisan's success in life is of the utmost importance. The fact is undeniable, and is becoming every day more apparent, that our American craftsmen are in this respect behind those of other countries. The best workmen in almost all skilled labor are those who have been trained in foreign workshops, and, in consequence, they hold the best situations. Something of this is, doubtless, owing to the fact that skilled labor is, as a rule, better paid in the United States than in Europe, and, consequently, large numbers of the best European workmen emigrate to this country. It is folly for us to cherish the belief that there is anything in the mere fact of a man's birth on this side of the Atlantic which makes him a better workman than one who is born abroad. One individual may, indeed, learn to do a thing more easily or more quickly than another individual, but it is because he is more highly endowed in certain requisite faculties —not because he is born in this place or in that. In neither case is skill to be acquired without persistent effort, and he who puts forth such efforts at the earliest period, and keeps them up most sedulously, is the one who will be sure to attain the highest success. Indeed, the opportunity for acquiring skill is perhaps the most valuable of all those which present themselves at the beginning of his career.

Something of the comparative unskilfulness of American artisans is owing to the almost universal abolition of the former apprenticeship system. In very few trades is there now any practical apprenticeship. The old terms "master" and "apprentice" are as good as obsolete; the persons formerly so designated are now simply employers and employés. The learner is taught only a part of the craft in the whole of which the former apprentice was instructed; and, strange as it may seem, the comparative high pay which he soon receives for his work prevents him from learning thoroughly even that part which he partially learns. As far as possible he works "by the piece," and his aim is to do as much work as he can, rather than to do it in the best manner. The universal introduction of machinery has much to do with this. Its inevitable influence is to tend to render the workman a mere attendant upon the machine, and, in so far as this is the case, the introduction of labor-saving machinery is certainly injurious to the artisan. There are, however, other aspects of the subject, which will be considered in a subsequent chapter.

It is, nevertheless, gratifying to note that there is a marked improvement in the technical education of American workmen. The establishment of technical schools and schools of art has much to do with this, both as cause and effect, and no subject is more deserving of earnest consideration than this. This improvement is most especially noticeable in the department of "Manufactures," which will be considered in the following chapter.

CHAPTER XXVII.

SUCCESS IN MECHANICS AND MANUFACTURES.

THUS far we have considered the artisan as a workman whose success in life depends mainly upon his own skill in his craft. Industry and temperance are of course presupposed; for these wanting, no degree of manual dexterity can bring wealth or comfort. Due economy is also presupposed; for no matter how much a man may earn, he is a poor man if he habitually spends, or tries to spend, more than his earnings. But there are still other conditions required for that success in life, some of the roads to which we are endeavoring to point out.

One's occupation must be judiciously selected, and even changed, if need be, or if more advantageous ones occur. It is unwise for a man to begin to make articles which no one wishes to purchase, or to go on making them when for any cause they have passed out of use. Wig-making was a lucrative trade in the days when no respectable man wore merely his natural hair. The thing which one has learned to make may have been a very useful one in its day, but if something better has been found to take its place, there is no use to go on making it. The craft of the armorer was the foremost one in Europe, in the ages when every man-at-arms was clad in steel from head to foot. Monk Schwartz — or whoever else it was that invented gunpowder—put an end to that craft. The trade of "fletcher," or bow-and-arrow maker, was at a time one of the most important and lucrative in England (men were accustomed to take their surnames from their trades, and there were almost as many Fletchers as Smiths); but the flintlock superseded the bow-and-arrow, just as the percussion-rifle superseded the flintlock. It is curious to look over some not very ancient book of handicrafts and see how many trades have become extinct.

Again, new means are continually devised by which an article of common use may be produced as well, perhaps better, or at all events more cheaply, than by existing methods. The application of machinery is the most striking example of this. In cases not a few, as in that of the sewing-machine, one invention has revolutionized entire industries. Not very long ago, in the making of a watch, a workman with a few simple tools cut separately every minute screw and wheel, every pinion and bearing. Now, one man, by the aid of a machine, will do in a day more than he could do in months by hand. One printing-machine does the work of many scores of hand-pressmen, and for the time throws many of them out of employment. The folding-machine has done the like for bookbinders; the planing-machine for carpenters, and so on; and the end is not yet. There are few departments of manual industry which are not liable to the invasion of machinery. It is by no means improbable that type-setting and type-distributing machines will in time come to take, to a large extent, the place of the compositor. Some of the failures in this direction tread very closely upon the heels of success.

There have been loud laments raised as machinery has been brought into competition with hand-labor in one industry and another — a competition which in most cases can have but one result. Laws have been proposed, and sometimes enacted and partially enforced, prohibiting or limiting the use of machinery. Workmen thrown out of employment have demolished the obnoxious machinery. The stocking-weavers of England broke in pieces the knitting-looms; the cotton-spinners set themselves in fierce opposition to Arkwright and his spinning-frame; the harvesters in England destroyed the reaping-machines, and burned the barns of those who used them; the silk-weavers of Lyons mobbed Jacquard, broke his looms in pieces, and threatened his life. He it was, they said, who, by his accursed inventions, was taking the bread from the mouths of their wives and children.

There can be no doubt that every invention which reduces the amount of manual labor in any branch of industry does, temporarily, reduce the number of workmen in that particular branch, and compels them to find other means of earning a livelihood. But in most cases a steady and permanent increase of laborers soon follows. The comparative cheapness of the articles produced enlarges the demand for them, and the manufacture is stimulated accordingly. What had been luxuries, attainable only by the few, become necessaries within the reach of the many. The invention of printing destroyed the trade of the calligraphers, who had been the sole producers of books; but the cheapening of literature so augmented the number of readers that it was not long before there were more persons earning their living by the new method of reproduction than there had been before by the slow and tedious process of copying.

Some great industries, which have come to be essential to a civilized community, are possible only by the employment of machinery, which apparently does away with so much hand-labor. A morning newspaper cannot go to press before midnight, and its whole edition, perhaps 150,000 sheets, printed on both sides, must be worked off as early as six o'clock in the morning. It would require at least 200 hand-presses to do the work of one printing-machine, and each press must have a separate cast of the types, a number which could not be produced, by any known means, within the requisite time. But suppose that this obstacle of time should be found not insuperable, the cost would still be so great that the paper could not be sold for anything like its price — say, two cents; it would be so expensive that only a comparatively small circulation could be reached. Without the perfected printing-press the daily newspaper, as we have it, would be an impossibility. The machine, while doing the work of perhaps 200 men, actually furnishes employment to many more — paper-makers, editors, newsdealers, and the like. The illustration might be carried on so as to reach almost every branch of industry, and with the same general result: While the introduction of machinery does undoubtedly, for a time, operate unfavorably upon those persons immediately affected by it, yet it so cheapens the cost that the amount of production is greatly enhanced, and either directly or indirectly augments the total amount of labor. Statisticians tell us that it would require 50,000,000 hand-spinners—more than the present population — to turn into thread all the cotton which is annually woven in England. Set every man, woman, and child in Massachusetts at a spinning-wheel or hand-loom, and all of them could not manufacture as much cloth as is produced by the 95,000 power-looms and 62,000 hands employed in the 175 cotton manufactories of that State. But the spinning-wheel and hand-loom are themselves machines of no inconsiderable power. If we had only the distaff and simple loom of the Hindoos, the entire labor of every inhabitant of the United States would not clothe the people as they are now clothed.

But while, in the general result, the introduction of machinery must be admitted to be of high benefit to the community, it is not the less certain that it may be detrimental to those with whose labor it comes into direct and immediate competition.

In the choice of an avocation, therefore, one should be careful to choose one from which he will not be likely to be driven out by machinery; and in almost every case he should be able to direct his energies into a new channel. It is well to be able to do some one thing perfectly; but the man who can do only one thing runs a great risk of not always finding that one thing to do. This uncertainty is a decided objection to what may be styled the "trade of office-holding." The man who obtains a clerkship under Government receives, perhaps, a somewhat greater salary than he would in like private employment, but in a few years he in a measure unfits himself for other occupations. In time the party from which he received his appointment is removed from power, and he is turned out by the incoming administration. As he owed his appointment to political influence, so he is liable to summary dismissal from the same cause. There are few persons so entirely helpless as the

Government clerk who, after a service of eight or ten years, finds himself suddenly displaced. In most cases the customs of society seem to require that he should live close up to his salary, to say nothing of the so-called "voluntary" assessments which are the bane and disgrace of our civil system—assessments which he will find to his cost to be not voluntary, but the most imperative of obligations. The position of clerk in any of the departments of Government is one which, taking all things into account, is among those to be least recommended to an aspiring and capable young man. The inducements at the outset are not great, and, besides the uncertainty, it gives slight promise for anything better.

Having learned a trade, one needs to exercise due care as to the location in which to practise it. The mere fact that in a given locality the members of any particular profession are comparatively few in proportion to the entire population is no evidence that this would present a favorable opening. In some cases the requisition for any particular industry is determined mainly by the physical conditions of climate and natural productions. A millwright would find nothing to do where there is no water-power, or a miner where there is no iron or coal, no gold or silver. But in more numerous instances this is determined by the characteristics of the general population, and, to a very great extent, by its mere density. The inhabitants of cities require some things which the rural population do not care for, many things which they do without, or make, after a fashion, each family for itself. Wherever society has had time to fairly organize itself, a paucity of persons engaged in any particular industry may indicate that this is not a profitable one in that locality. A comparison of the distribution of some industries that might in themselves be carried on in any locality presents some instructive features.

Table XXIX. shows, for the entire United States and for each of the eleven principal States, the ratio between the total population and the number of persons occupied in fifteen of the leading mechanical industries. Thus, in the entire Union there are 290 persons to one blacksmith; in Alabama there are 610;

in California, 184; in New York, 252. In the whole Union there is one printer to every 690 persons; in New York there is one to every 300; in Virginia, one to every 1820; in Alabama, one to every 3860, and so on.

TABLE XXIX.—DISTRIBUTION OF TRADES IN THE UNITED STATES.

States.	Total Number of Population for One Person of Each Trade.														
	Blacksmiths.	Boot and Shoe Makers.	Cabinet-makers.	Carpenters and Joiners.	Carriage-makers.	Coopers.	Harness and Trunk Makers.	Machinists.	Masons and Stone-workers.	Millers.	Painters and Varnishers.	Printers.	Tailors and Dress-makers.	Tinners.	Wheelwrights.
Alabama.	610	1,751	6,500	412	6,132	8,586	9,163	2,423	1,803	1,169	2,710	3,860	580	7,240	8,417
Cal......	184	189	628	95	1,024	1,563	760	474	189	1,581	260	888	91	758	2,728
Georgia..	532	1,320	4,070	305	4,221	5,263	3,102	2,202	1,230	1,029	1,672	2,190	390	5,690	4,895
Iowa....	335	612	1,639	146	855	1,673	843	1,425	445	831	514	812	180	1,354	19,812
Maine...	234	129	1,625	97	837	658	962	521	196	1,417	333	857	90	1,280	2,627
Missouri..	309	563	985	172	850	899	903	850	428	847	511	692	185	1,232	18,376
New York.	252	190	426	102	710	580	953	313	213	1,182	198	300	490	602	4,333
Ohio....	219	290	570	107	456	595	873	425	298	811	280	687	97	960	3,110
Tenn....	376	1,040	2,008	296	1,895	2,938	2,640	1,832	877	883	1,598	2,309	514	3,494	9,353
Texas...	565	1,693	3,119	280	3,187	15,454	2,010	2,245	931	1,447	1,614	1,693	637	3,133	5,644
Virginia.	324	1,820	1,905	183	1,891	1,310	2,152	1,322	707	600	1,351	1,820	311	2,990	1,512
All States.	290	258	825	134	920	1,027	1,167	498	371	939	390	690	120	1,172	3,216

The States selected contain nearly one-half of the population of the Union, and each of them may be considered a fair representative of several others closely connected with it by geographical position and general characteristics of society. Thus, Maine represents New England; California the Pacific States; New York the Northern, and Virginia the Middle Atlantic States; Ohio the older and Iowa the newer of the Western States, and so on. There is a marked dissimilarity in the distribution of mechanics in the several groups, but a similarity quite as marked between the States of the same group. The ratio of mechanics to the population is much the largest in New England and the Pacific States, and much the smallest in the Southern States; and in the remaining groups it is somewhat larger in the older than in the newer States.

This shows that the general distribution has conformed itself to the present local requirements. If it could be presumed that the existing conditions of society would remain as they are, there would be no doubt that the States in which slavery formed a distinctive feature of society would offer very slight inducements to the mechanic and artisan as compared with other sections. But the whole structure of Southern life is being rapidly reconstructed, and the new developments must greatly increase the demand for the products of mechanical industry. It is not merely, nor even mainly, that the colored people will not content themselves with what measurably satisfied them in their former condition. The augmented demand for the productions of the mechanic will come at least, in the outset, from the other quarter. The farmer and planter will not be contented with the kind of dwelling which satisfied the aspirations of his fathers, nor with the furniture which corresponded with those comparatively rude dwellings.

Why, for example, should the resident of Georgia be worse housed than the resident of Iowa? The area and population of the two States do not differ greatly, but Iowa has more than 11,000 carpenters and joiners, while Georgia has less than 5000, and Ohio, with twice the population of Tennessee, has nearly six times as many carpenters to build her houses. The same holds good in regard to masons. Georgia has only one-third as many as Iowa; Tennessee, one-sixth as many as Ohio. So, also, with the painters and paper-hangers, who decorate the exterior and interior of our dwellings. Taking the whole Union together, one of these does the work required by 390 inhabitants; but in California there is one for every 260, and in Ohio one for every 198; and there is no complaint that these avocations are overcrowded. In Virginia there is only one house-painter to every 1351 of the population; in Georgia, one to every 1672; in Alabama, one to every 2710.

We imagine that the demand for more mechanical industry in these Southern States will manifest itself at first most decidedly in those branches which pertain to building, for the reason that these must be carried on upon the spot, while the products of many trades can be brought from a distance. It is not to be expected that the requirements for increased mechanical industry will be very suddenly apparent; but, upon a survey of all the conditions, it is every way likely that the most promising openings lie in those sections where the ratio of artisans to the population is below the general average. Where it is greatly above the average it may be reasonably assumed that the supply treads hard upon the fully developed demand; but where the number falls greatly below the general average, without any permanent natural reason, it may be presumed that an increased demand will spring up.

But there are certain exceptions to this general principle. Thus the trade of a printer will inevitably be mainly carried on in large towns. Books and great journals will always be chiefly printed in the principal cities: a very sparsely peopled section cannot support even its local newspaper and jobbing office. Such trades as that of the dyer, the jeweller, the engraver, the photographer, the bookbinder—all indeed which produce articles of taste and luxury rather than of convenience or necessity—will inevitably be concentrated in cities and towns instead of being diffused through rural neighborhoods. The engineer will find occupation only where there are engines to be run, and the machinist in localities where there are machines to be constructed or repaired, and consequently where the necessary materials and appliances, such as iron, brass, coal—perhaps water-power—are readily accessible.

In some industries—as in the manufacture of agricultural implements, of carriages and cars, of sewing-machines, of firearms, of clocks and watches, etc.—a number of separate trades are combined to produce a single article; and these trades are concentrated into a single establishment, which forms the nucleus of a town, and not unfrequently constitutes a town of itself. Such establishments, in common with all other manufactures, involve matters for special consideration. The most obvious feature of them is, that most of the work is performed by machinery; and, in so far as this is the case, the most dexterous workman may become a mere attendant upon the machine. One workman comes to be the attendant of but a single kind of machine, and all that he can learn of his trade can be speedily acquired. There will, indeed, be some few persons required who have special skill in doing something which machines cannot as yet perform, and these may receive exceptional pay; but they are few when compared with the whole number, and the general rates of wages approximate more and more to those of operatives in cotton and woollen mills, which, as already shown, are decidedly below the average of mechanics in general.

Every artisan should be to some degree a man of business also. If he have an enterprising spirit he will not be apt to content himself with remaining a mere employé, but will wish to go into business for himself, and thus keep in his own hands that portion of his earnings which would otherwise rightfully go to his employer; and, if at all successful, he will himself become an employer, having other workmen under him. The earnings of this class of artisans do not appear in our tables and in the Census Report under the head of "wages," but are included in the balance of the "values of products" which remains after deducting the "wages paid" and the "cost of materials." These master mechanics, if at all successful, of course gain much more than the average of their respective crafts, and usually more than the most skilful of those who remain employés; and the greater number of those who become even moderately wealthy belong to this class.

Employers must of necessity be few in comparison with the whole number of artisans, and the ratio is constantly decreasing. During the period from 1870 to 1880 there was scarcely a perceptible increase in the number of "establishments," although the number of workmen increased about 30 per cent. Taking all establishments together—from those having not more than two or three, to the great factories, each having hundreds and even thousands—there were, in 1870, about eight workmen to one employer; in 1880, nearly eleven to one; and there is no reason to doubt that the ratio of the number of employers to employés will grow smaller and smaller in the future. The great establishments gradually "eat up" the smaller ones.

At first view this change appears to be one to be deprecated. It does not seem to be well for the community that three men should be made considerably the poorer in order that one man may become very much the richer. But, on the other hand, it may be said that the great establishments crush out the smaller ones, only because they turn out as good or better products at a cheaper rate; and so the great mass of the community is benefited by the change, and they who lose by it are few in comparison with the ones who gain. Those who take this view of the case point to the undeniable fact that—leaving out of view the very poorest classes, who could not well be much poorer than they are—the great body of the community are better off than they formerly were; they are, upon the whole, better housed, better clothed, better taught, and certainly not worse fed. But whether the change is, in all respects, for the better or for the worse, it is inevitable. Great establishments will produce more cheaply than smaller ones, and men will buy where they can buy the cheapest. The best that any individual can do is to conform himself to what he cannot avoid.

What, then, are the essential conditions of success in those departments of productive industry which are now under consideration?

First and foremost are skill and energy. Competition is so great that whoever enters upon such a career must not only bring to his work ceaseless activity, but much thought and forecasting. The manufacturer, of whatever degree, must be continually on the alert to know what improvements are making or likely to be made in the processes employed in his business: he cannot afford to lag behind in the race. If he be able to originate improvements—to be an inventor as well as an appropriator of the inventions of others—he cannot, unless otherwise incompetent, fail of success. We are indeed told that the real inventors of great improvements rarely reap the rewards of their genius. This is even partially true in a less proportion of cases than is assumed, and is wholly true only in those exceptional cases where the inventor lacked some other important requisites for success.

The inventor is not the man who conceived the first crude idea, and then from any cause failed to develop it to the proper extent, even though that crude idea be essential to the perfected invention; but the one who puts the conceptions of others as well as his own into a practical shape. James Watt, not Solomon de Caus or the Marquis of Worcester, was the true inventor of the steam-engine. Robert Fulton, not John Fitch, or any other man of the scores for whom the honor has been claimed, was the inventor of the steamboat. George Stephenson, well styled "the Father of Railways," was the inventor of them, although what he did was simply to "marry the track to the locomotive," both of which, although in a rude form, he found ready for his use. It is rare, indeed, that an invention is completed at once; in most cases it is gradually developed by slow steps; and not unfrequently he who might have been the inventor has failed to become so because he lacked the persistency, or perhaps the means, to perfect his first conceptions. But making all due allowance for failures from all causes, it will be found that the real inventors of any great improvement have in most cases reaped high rewards. True, many others have shared very largely in these rewards, but they were the men who had the sagacity to perceive the value of some invention which they themselves could never have originated.

For a man of native inventive genius there is no avenue to success so promising as that of the exercise of this faculty. There is no reason to suppose that the field for inventions in any one department of industry is half occupied. The records of the patent-office tell a different story, and will continue to tell it. How far, for example, are we from applying the possibilities of electricity as a motive-power? One caution may not be out of place. It is wiser to employ one's time and energies in perfecting a few inventions—or even one—than in half perfecting many. The profit lies in the completed invention, not in its original and partial conception. This subject will be more fully considered in another chapter.

The highest requisite for success—which virtually includes very many—is *Honesty*, involving much more than the mere absence of positive cheating, or even of what are euphemistically styled "tricks of the trade." No man who aims at success can afford to play any such tricks. Even were there no higher considerations, they are sure to be found out. In the very broadest acceptation of the terms, "Honesty is the best policy." As far as any success in life worthy to be so called is concerned, it is the only true policy. Any apparent success gained by other means is a bane and a disgrace to the acquisitor. The articles which one makes should be good of their kind; if the best of their kind, so much the better for the producer. In any case they should be just what they profess to be. Not only should the maker refrain from representing them to be other than they are, but they should not be made to represent themselves to be what they are not. "Let the buyer look out for himself" is a maxim of questionable morality as commonly understood. The buyer will be quite sure to "look out" for himself, and when he finds that he must also "look out" for the seller he will be apt to make his purchases elsewhere.

It behooves the manufacturer to establish not merely an unimpeachable personal character, but an unimpeachable character as a manufacturer—that is, in order to attain high success he must acquire a high character for his goods. Such a character is emphatically a plant of slow growth—it is a work of time; but, once attained, it is a permanent possession. There are few species of property of more pecuniary value than a "trade-mark," which has come to be recognized as a guarantee for the quality of the articles sold under it, and there is no kind of property the exclusive right to which is more sedulously guarded by law, and the infringement of which is more certainly punished. Better, as far as money is concerned, steal a man's purse than pirate his trade-mark. As well forge his signature to a note of hand as counterfeit his peculiar trade-mark upon wares of your own. And the law wisely takes a very liberal view of the right which it has created in a trade-mark. An evident imitation, calculated to deceive even the unwary, is a violation, to be restrained or even punished, as well as a palpable counterfeit.

An established name for any article, or "brand," for any particular species of it, is valuable in two ways. It commands a higher price, if the manufacturer chooses to ask it, than would otherwise be paid. As a matter of fact, however, such established manufacturers do not find it to their interests to charge for their wares a price greater than that for which others could make the same goods. An exception to this would probably be made in most cases in which there is a patent for the manufacture, not merely a trade-mark to identify the articles manufactured. Their advantage lies rather in the increase of sales than in the enhancement of prices for the goods above what is required for a reasonable profit. The purchaser buys these goods in preference to others, simply because the name of the manufacturer is a warranty for the quality of the goods. Other manufacturers who produce wares equally as good must, in order to effect sales to any amount, sell at somewhat lower prices until they have likewise acquired an equally high reputation.

Instances without number might be adduced of the pecuniary value of such a reputation. Perhaps the Collins axes, the Ames shovels, the Cooper glue, and the Brewster wagons, are no better in themselves than the best of those of other manufacturers; but then acknowledged reputation of itself gives them a wider and therefore a more profitable market. There are publishers of books whose imprint upon a volume is accepted by the public as a warranty that it is of high value in its class. The fact that a work is issued by such publishers will of itself insure a sale at once which the same work might never reach if issued by a publisher who still had his reputation to make; just so in the case of an author who has won a reputation. A poem by Longfellow or Tennyson or Whittier, a novel by Black or Reade or Frances Hodgson-Burnett, a history by Bancroft or Greene or Lossing, a school-book by French or Willson or Swinton, finds purchasers at once, when bearing their names, which it would not have found for a long time, if ever, had it appeared anonymously. It required twelve years to find purchasers for an edition of five hundred copies of "Nature," the first book, and by many held to be the best, of those written by Emerson, then an unknown author, while of his later works thousands were sold on the day of publication.

But such a reputation, though difficult to gain, is easy to lose, and when impaired is hard to regain. There can be no more short-sighted policy than for one whose wares, be they what they may, have acquired a reputation to suffer their character to deteriorate. One cannot go on very long trading upon the capital of a past reputation. It must be kept up—"the mill never grinds again with water which has passed." One instance will serve as an example of the care with which some manufacturers find it to their interests to guard their business character: A leading establishment produces goods in solid silver and in plated ware, each kind equally characterized by artistic design and workmanship, and the two kinds cannot be distinguished one from the other except by cutting into them. Each kind bears its distinctive trade-mark, showing which it is, and, moreover, the same pattern is never used for cup or fork or spoon for both kinds of ware. It happened upon a time that by some accident a quantity of silver was wrought into the plated form, and the manufacturers themselves could not distinguish which was which. They therefore sold the whole of both kinds as plated ware, and those who happened to get the silver articles reaped the benefit of the accident, while the manufacturers bore the loss.

It is not very long since our manufacturers were accustomed to make up certain goods after foreign patterns, and put foreign labels upon them, so that they were sold, at least to the consumers, as imported goods. In the case of woollen, cotton, and silken goods, it is believed that this semi-fraudulent practice has gone almost entirely out of use. Manufacturers have found that they can produce nearly all of these goods of a quality nowise inferior to those of their European competitors; and they are setting themselves strenuously at work, and with ample success, to establish a reputation for their own goods under their own special trade-marks. If a customer fancies that British or French cloths must of necessity be better than corresponding American ones he can gratify his fancy by paying an advanced price. But the chances are more than even that the goods have nothing imported about them except the label, and that is most usually affixed, not by the manufacturer, but by the

A SOUVENIR.

See Note 23.

not over-scrupulous tradesman. So superior, indeed, are some of our standard cotton goods to those of the British manufacturers that large quantities of these goods, woven at Manchester, are exported to the East, stamped as the product of New England mills.

Sardines have long been put up on the coast of Maine, but until quite recently no one ever saw an American sardine for sale. The boxes all bore a French label. This might be explained so long as it was supposed that olive-oil only was fit for making sardines, and that olive-oil only was used in France for this purpose. But the case was changed when it became known that our cotton-seed oil was largely substituted for olive-oil in Europe. It is not altogether certain that the one is not as good as the other for this purpose, but it is clear that the cotton-seed oil is not converted into olive-oil by a voyage across the Atlantic and back. American sardine-packers are beginning to understand that the true way to compete with their French rivals is to equal or excel them in the quality of the article, and to sell it honestly for just what it is. So now we find American sardines sold as such.

The same is coming to be the case as regards articles such as pickles, preserves, canned vegetables, fruits, and the like. Some wines and liquors are doubtless among the last articles of American product which will be sold as imported. But when it is borne in mind that the chances that every bottle of champagne or port or sherry or brandy which is actually imported is a factitious compound, or one more or less largely adulterated, it matters little on which side of the ocean the fraud is perpetrated. The less one uses these articles, the more sure he will be of not being imposed upon.

To sum up the main conditions for success in the direction now under consideration:

First. Choose well the particular avocation in which you are to engage, having special reference to your own qualifications, mental as well as physical. If you are of delicate frame, the trade of a blacksmith or carpenter is not for you. If your fingers are greatly deficient in suppleness, and in celerity of movement, the craft of a compositor or engraver is not the one for you. If you happen to be color-blind, do not try to become a painter. If there be no special disqualification, then, of all the occupations open to you, select the one which promises to pay best. If, for any reason, or even for no reason which you can definitely assign, you have a liking for any particular trade, that one, other things being equal, should be chosen. If you are fond of reading, that is a good reason for becoming a printer; if you have a natural mechanical turn, you are specially fitted for a machinist, a cabinet-maker, or a millwright; and all the more so if you have an inventive genius. The inventor who cannot with his own hands make, at least, a model of his invention labors under a serious, though not an insuperable, disadvantage.

Second. Make yourself a thorough master of your trade, including the use of all the machinery and other tools used in it; but do not so confine yourself to it as to render yourself incapable of doing anything else. No one handicraft is sufficient to exhaust all the capacities of any one man. You will be the better painter for being able to handle the saw; the better joiner for knowing how to use the brush; the better machinist for acquiring the use of the pencil.

Third. Having learned your trade, whatever it may be, look well for a location in which to exercise it. It is as important to know *where* to do a thing as *how* to do it. Do not become so enamored of your present abode as to refuse to leave it for a better one; nor so given to change as to seek it merely for its own sake. Of course, the healthfulness or unhealthfulness of a place is a great reason for or against choosing it. Upon this point more will be said hereafter.

Fourth. Be on the alert for opportunities to better your condition. Look for them, for it is not often that they will come unsought, or that accident will throw them in your path. It is very right and proper to be "always contented with our present condition," provided always that is the one we are best fitted to fill. But it is by no means certain that the condition in which one finds himself is the one in which Providence designed him to remain. The true condition which Providence designs for a man is the best honest one to which he can honorably attain, and the work of which he can honestly perform. To George Washington it may have seemed at a time that the lot of a land-surveyor was the one divinely appointed to him: and he would certainly have been a very good surveyor. Richard Arkwright seemed to be called to no better vocation than that of a barber, shaving rough beards in a cellar at a penny a chin, as his father had done before him. His inventive faculties were first turned to the folly of discovering a machine for perpetual motion. Yet Providence willed that he should not be content in his condition until he had invented the spinning-frame, in which lay potentially the manufacturing greatness of England and the wealth of the cotton-fields of America. Robert Fulton found himself a miniature-painter in early manhood, and with his best efforts only an indifferent one; that, as we now see, was not the position in life with which he should have been satisfied. George Stephenson was a collier's helper, ignorant of the alphabet until he had almost reached manhood. When, at thirty, he was made an engine-driver at £100 a year, he thought that he was "a made man," and had reached the highest station to which Providence had assigned him; but Providence willed that he should not be content in that condition. Had Peter Cooper remained in any one of the various occupations to which Providence had apparently called him, we cannot well imagine how great losers we should have been. It is the men who have *not* been "content with their present condition," but have always yearned after and striven for something better, who have not only improved their own affairs, but those of the world.

Fifth. To skill and industry, persistence and energy, with intelligence to guide them, add honesty in act and purpose. Be content with no present state, however good, so long as there appears to be something beyond attainable. However high you have climbed, let your motto and watchword still be, "*Excelsior*—yet higher!"

CHAPTER XXVIII.

TRADE AND TRANSPORTATION.

THE industries of trade and transportation differ from those of agriculture and manufactures in this, that they are employed not in producing articles of any kind, but in giving additional value to those already produced by changing their location so as to render them more accessible to the consumer. There were, in 1880, in the United States, 1,810,256 persons engaged in trade and transportation. Of these 1,750,892 were males and 59,364 females; of both sexes there were 28,615 individuals between the ages of ten and fifteen. The following is the classification of the Census Report, with the number of persons employed in each separate branch:

Agents (371 females), 18,523. Bankers and brokers (133 females), 19,373. Boatmen and watermen (11 females), 20,368. Book-keepers and accountants in stores (2365 females), 59,790. Canal-men (48 females), 4329. Clerks in stores (23,722 females), 353,444. Clerks and book-keepers in banks (74 females), 10,257. Clerks in express companies (8 females), 1856. Clerks in insurance offices (53 females), 2830. Clerks in railroad offices (57 females), 12,331. Commercial travellers (272 females), 28,158. Draymen, hackmen, etc., 177,586. Employés in warehouses (206 females), 5022. Employés of banks, not clerks (21 females), 1070. Employés of insurance companies, not clerks (105 females), 13,146. Employés of railroad companies, not clerks (447 females), 236,058. Hucksters and peddlers (2492 females), 53,491. Milkmen (326 females), 9242. Newspaper carriers (76 females), 3374. Officials and employés of express companies, not clerks (11 females), 13,004. Officials and employés of street-railway companies (4 females), 11,925. Officials and employés of telegraph companies (1131 females), 22,809. Officials and employés of telephone companies (16 females), 9702. Officials of banks, 4421. Officials of insurance companies, 1774. Officials of railroad companies, 2069. Packers (526 females), 4176. Pilots, 3770. Porters, etc. (2524 females), 32,192. Sailors, 60,070. Salesmen and saleswomen (7744 females), 32,279. Saloon-keepers and bartenders (1308 females), 68,461. Shippers and freighters (6 females), 5166. Steamboat men and women (183 females), 12,365. Stewards and stewardesses (298 females), 2283. Toll-gate and bridge keepers (418 females), 2303. Traders in agricultural implements (2 females), 1999. Traders in books and stationery (199 females), 4982. Traders in boots and shoes (186 females), 9993. Traders in cabinet-ware (84 females), 7419. Traders in cigars and tobacco (534 females), 11,866. Traders in men's clothing (199 females), 10,073. Traders in coal and wood (90 females), 10,871. Traders in cotton and wool (10 females), 2494. Traders in crockery, etc. (124 females), 2573. Traders in drugs and medicines (120 females), 27,700. Traders in dry-goods, fancy-goods, etc. (4060 females), 45,831. Traders in gold and silver ware and jewellery (41 females), 2305. Traders in groceries (3974 females), 101,849. Traders in hats, caps, and furs (87 females), 4809. Traders in ice (12 females), 2854. Traders in iron, tin, and copper ware (62 females), 15,076. Traders in junk (71 females), 3574. Traders in leather and hides (2 females), 2382. Traders in liquors and wines (132 females), 13,500. Traders in live-stock (14 females), 12,596. Traders in lumber (8 females), 12,263. Traders in marble, stone, and slate (7 females), 1405. Traders in music and musical instruments (45 females), 1906. Traders in newspapers and periodicals (107 females), 2729. Traders in oils and paints (14 females), 1940. Traders in paper and paper-stock (47 females), 1862. Traders in real estate (39 females), 11,253. Traders in sewing-machines (99 females), 6577. Traders not specified (3746 females), 113,017. Undertakers (55 females), 5113. Weighers, gaugers, and measurers (11 females), 3302.

The foregoing list shows the distribution among the several branches of all the persons engaged in trade and transportation. The "traders not specified" are those who deal in a great variety of articles, buying whatever they think they can sell. It will be observed that there are few of these occupations in which females, to a greater or less extent, are not engaged. This opens up an inquiry which will be further pursued in the chapter on "Work for Women."

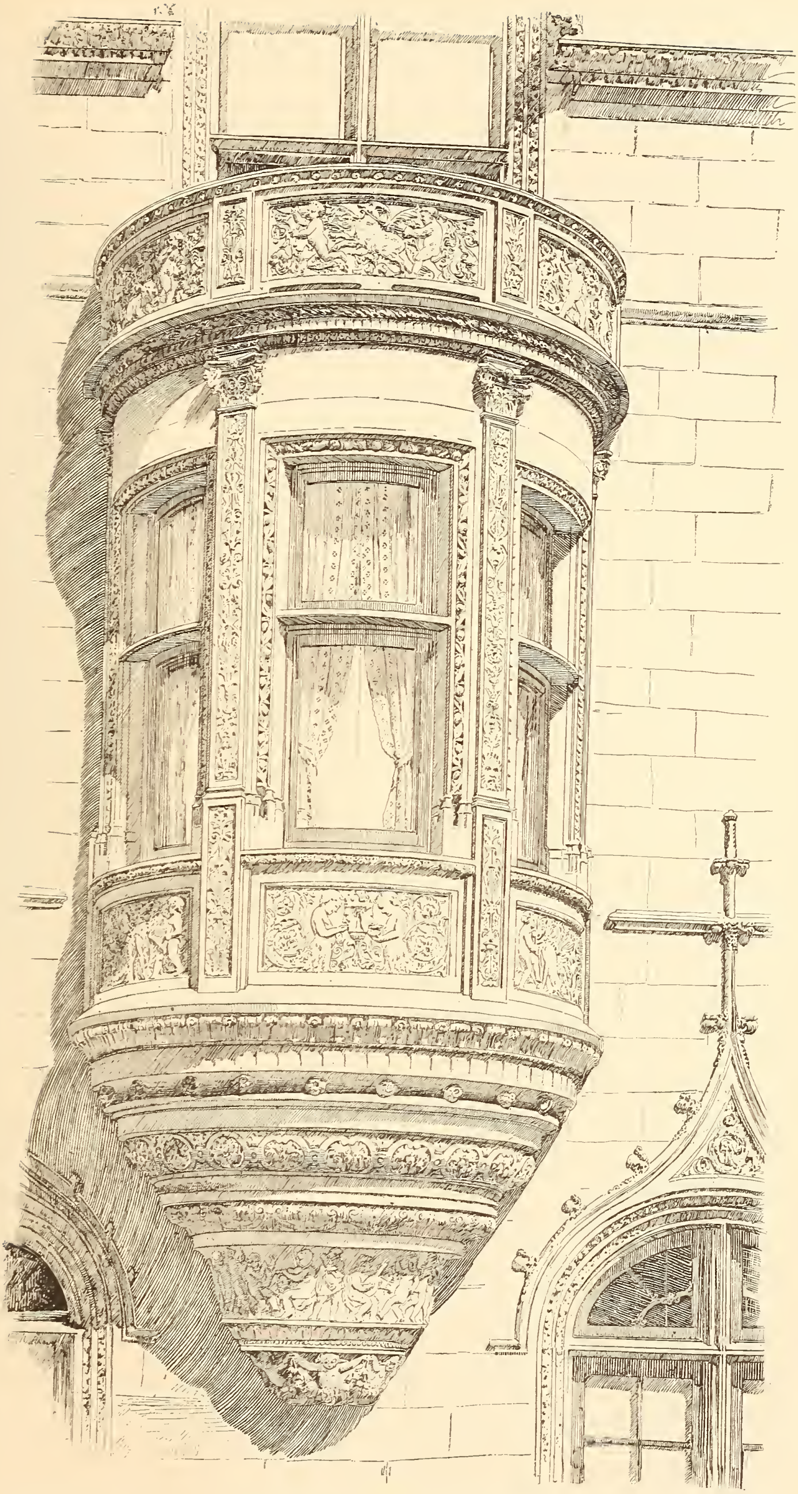
Railroads.

The first railroad operated by steam was opened in England in 1825; the first in the United States, in 1832. At the present time (1884) there are probably more miles of railroad in operation in the United States than in all the rest of the world. They form the most important factor in our internal transportation, and have greatly modified our system of trade. At the end of June, 1880, there were in the United States 1146 railroad companies having roads in operation. There were 87,891 miles in operation, besides 19,722 miles projected. There were also 336 new companies, having 21,307 miles of projected road. Between June, 1880, and January, 1882, 16,922 miles were completed, so that there were then 104,813 miles in actual operation. The following will show the progress of railroad-building in the United States:

In 1830 there were in operation 23 miles; in 1831, 95 miles; in 1832, 229 miles; in 1833, 380 miles; in 1834, 633 miles; in 1835, 1098 miles; in 1836, 1273 miles; in 1837, 1497 miles; in 1838, 1913 miles; in 1839, 2302 miles; in 1840, 2818 miles; in 1841, 3545 miles; in 1842, 4026 miles; in 1843, 4185 miles; in 1844, 4377 miles; in 1845, 4633 miles; in 1846, 4930 miles; in 1847, 5998 miles; in 1848, 5996 miles; in 1849, 7365 miles; in 1850, 9021 miles; in 1851, 10,982 miles; in 1852, 12,908 miles; in 1853, 15,360 miles; in 1854, 16,720 miles; in 1855, 18,374 miles; in 1856, 22,016 miles; in 1857, 24,503 miles; in 1858, 26,968 miles; in 1859, 28,789 miles; in 1860, 30,635 miles; in 1861, 31,286 miles; in 1862, 32,120 miles; in 1863, 33,170 miles; in 1864, 33,908 miles; in 1865, 35,085 miles; in 1866, 36,801 miles; in 1867, 39,250 miles; in 1868, 42,229 miles; in 1869, 46,844 miles; in 1870, 52,914 miles; in 1871, 60,283 miles; in 1872, 66,171 miles; in 1873, 70,278 miles; in 1874, 72,383 miles; in 1875, 74,096 miles; in 1876, 76,808 miles; in 1877, 79,089 miles; in 1878, 81,776 miles; in 1879, 86,497 miles; in 1880, 93,671 miles; in 1881, 104,813 miles.

Dividing the half century from 1832 to 1881 into periods of ten years, we find that from 1832–1841 3420 miles of railroad were built; from 1842–1851, 7447 miles; from 1852–1861, 20,304 miles. The civil war seriously checked railway-building, but it was resumed with increased energy upon the restoration of peace, and from 1862–1871 were built 28,997 miles; from 1872–1881, 44,503 miles. In 1881 were completed 11,142 miles, against 7144 in 1880, and 4721 in 1879.

The total cost of building the railroads of the United States, up to June 30, 1880, was $4,112,367,176, or $47,387 per mile. The cost of equipment was $418,045,458; other items, such as buildings, telegraph lines, etc., brought the whole permanent investments up to $5,182,445; or, including all cash assets, to $5,536,419. The capital stock paid in was $2,613,606,264; the debt, funded and unfunded, was $2,812,116,296; thus, the total capital paid in and borrowed was $5,425,722,560. The gross



BAY-WINDOW IN W. K. VANDERBILT'S HOUSE, FIFTY-SECOND STREET, NEW YORK.

See Note 24.

income, from all sources, was $661,295,391; the expenditure, for all purposes, including the interest upon debts, was $541,950,795; leaving, for net income or profit, $119,344,596, or 4.57 per cent. upon the capital stock. From this, dividends amounting to $70,550,342 were declared, $48,794,254 being retained as surplus.

But about one-fifth of the railroad capital is invested in companies which earn no dividends; that is, their income is not sufficient to more than pay the interest upon their debt and the running expenses. There were reported 542 companies, with a capital of $510,538,018, earning no dividends. The remaining 623 companies, with a capital of $2,103,068,246, declared dividends of various amounts, from 1 per cent. up to 20 per cent., the average of these for the entire United States being 6.32 per cent.

These figures, taken together, show clearly that, as a whole, the capital in railroads has not as yet been profitably invested. Immense fortunes have been made by a few persons by this means, but in very many cases they have been gained by buying up, at low rates, the stock of unpaying companies, and holding it until the roads began to pay. A considerable portion of the original stockholders have lost by their investments. Of the few fortunes that have been acquired, and the many that have been lost by speculations in railroad stocks, we do not here speak, further than to say that it is the height of folly for any man who has in his possession a moderate capital, to risk it in stock-speculation of any kind. It is a species of gambling, and in all gambling operations the aggregate of losses must be greater than the aggregate of winnings. The losers, not the winners, pay the expenses of carrying on the game.

It may, however, be reasonably presumed that the profits of railroad enterprise will be, upon the whole, much greater than they have heretofore been. There are few or no roads which, with their present equipment, could not do more business than they are now doing; and as the country becomes more densely peopled the amount of business will increase in a greater ratio than the operating expenses, thus leaving a larger residue for profit.

Railroad Employés.—The whole number of railroad employés in 1880 was 418,957. They were thus distributed: General officers, 3375; general office clerks, 8655; station men, 63,380; trainmen (comprising 18,977 engineers, 12,419 conductors, 48,254 others), 79,650; shopmen (comprising 22,766 machinists, 23,202 carpenters, 43,746 others), 89,714; trackmen, 122,489; all other employés, 51,694. The pay-roll for the year amounted to $195,350,013, an average of $466 per year. A few of them received very much more than this; most of them considerably less. This average is probably about that paid to conductors. The wages earned by railroad employés do not differ materially from what is paid in similar employments in other departments of industry, being probably a little higher in the case of skilled labor, and a little lower in the case of unskilled labor.

Passengers and Accidents.—The number of passengers (that is, of passages) was 269,583,340: the average length of a passage being 23 miles. That is, averaging the whole, every person in the United States made from four to five railway journeys a year, and rode a little more than one hundred miles. There were 8215 casualties—2541 persons being killed and 5674 injured. Of these 6348 (2174 killed and 4174 wounded) are reported to have suffered "through their own carelessness," and 1802 (364 killed and 1438 wounded) "through causes beyond their control." Of those killed or injured, 4540 were employés of the roads, 687 were passengers, and 2988 were neither passengers nor employés. From this it appears that each passenger, in travelling 23 miles by rail, runs one chance in about 400,000 of being killed or injured; and as there were 305 passengers who suffered "through their own carelessness," each passenger runs one chance in about 715,000, in every 23 miles of travel, of being killed or injured "through causes beyond his control." The risk is very much greater for employés of the roads, of whom one in 90 was either killed or injured during the year — about one-half of them through no carelessness of their own.

Canal Navigation.

There are within the United States 2926 miles of navigable canals (including 411 miles of slack-water navigation), of which 784 miles are in Pennsylvania, 749 in Ohio, 723 in New York, and 200 in Maryland, the remainder being in eleven other States. The cost of their construction was $170,028,636; their gross income, in 1880, $4,538,620; total expenditure, $2,954,156. Besides these there are about 2000 miles of abandoned canals, constructed at a cost of about $44,000,000. It is not probable that any more canals will be constructed, except for the purpose of connecting bodies of slack-water navigation. Practically, except in a very few instances, railroads have superseded canals for purposes of transportation.

Steam Navigation.

The United States has 5139 miles of "waters with a navigable outlet, and subject to customs and inspection laws." Upon these, in 1880, were 5139 merchant steamers, having a tonnage of 1,221,206,093 tons, and valued at $80,192,495. The capital invested in them was $112,005,600, and their gross earnings amounted to $85,091,007, being 80 per cent. on the capital invested. Their crews numbered 53,843 persons (including 7032 "roustabouts," or irregular hands, employed at low wages on the western rivers); the wages paid to them amounted to $25,451,-404, an average to each, including officers, crews, and roustabouts, of $409. The Census Report arranges these waters into ten groups, as follows:

I. *The New England States:* Number of steamers, 463; tonnage, 118,553; value, $7,890,550; crews, 5645 persons; average wages, $472 per year. II. *The North-western Lakes:* Number of steamers, 947; tonnage, 222,290; value, $13,918,925; crews, 9143 persons; average wages, $360. III. *The Upper Mississippi:* Number of steamers, 366; tonnage, 83,918; value, $3,004,050; crews (including 2950 roustabouts), 7824 persons; average wages, $282. IV. *The Ohio:* Number of steamers, 473; tonnage, 107,472; value, $5,661,500; crews (including 2000 roustabouts), 9090 persons; average wages, $313. V. *The Middle States:* Number of steamers, 1459; tonnage, 432,803; value, $2,851,550; crews, 17,268 persons; average wages, $510. VI. *The Lower Mississippi:* Number of steamers, 315; tonnage, 48,303; value, $2,851,550; crews (including 1696 roustabouts), 5655 persons; average wages, $288. VII. *Gulf of Mexico:* Number of steamers, 126; tonnage, 41,610; value, $3,272,800; crews, 1919 persons; average wages, $530. VIII. *The South Atlantic Coast:* Number of steamers, 266; tonnage, 30,833; value, $2,515,300; crews, 1886 persons; average wages, $448. IX. *The Pacific Coast:* Number of steamers, 319; tonnage, 97,004; value, $6,477,500; crews, 3008 persons; average wages, $650. X. *The Upper Missouri:* Number of steamers, 40; tonnage, 12,099; value, $402,300; crews (including 386 roustabouts), 1047 persons; average wages, $288.

The mercantile water-craft of the United States, of all descriptions, in 1880, was: *Steamers*, 5139; tonnage, 1,221,206; value, $80,192,495. *Sailing Vessels*, 16,820; tonnage, 2,366,132; value, $59,152,950. *Canal-boats*, 8871; tonnage, 1,253,688; value, $8,273,255. *Barges*, 5033; tonnage, 1,331,562; value, $6,430,562. *Flats*, 2072; tonnage, 220,690; value, $1,286,020. *Wharf-boats*, 145; tonnage, 86,390; value, $385,100. *Hulks*, 46; tonnage, 7638; value, $64,425—*Totals:* Vessels, 38,656; tonnage, 6,487,309; value, $155,784,709.

Telegraphs and Telephones.

At the close of the census year 1880 there were 77 telegraphic companies in the United States, but the principal lines were practically consolidated into the "Western Union," which performed fully three-fourths of the whole telegraphic service. The entire capital stock was put down at $67,901,255; gross receipts, $16,696,026; expenses, $10,062,921; leaving net receipts, $6,633,105. But since the date of the census there has been a large increase in the telegraph business in every respect. The Census Report makes the whole number of officers and employés 22,809, but many of these were employed only a part of the time, the average number being 14,928. The total wages paid amounted to $4,866,128, or an average of $326 per year. The operators numbered 9661, of whom about one-eighth were females. Since then there has been a large increase, the females now constituting about one-fourth of all persons engaged. The males receive from $25 per month, for boys and beginners, up to $100, by a few, the average being $75 per month. The female operators receive from $25 to $65 per month, the average being $45. The telephone companies had, according to the tables of the Census Report, 1197 "officials and employés," but an additional statement brings the number up to 3338. The rates of wages are essentially the same as stated above.

It will be seen that telegraph operators receive wages considerably above the average rates paid to artisans. It is an occupation which requires some special qualifications. In addition to intelligence, the operator must have a sensitive physical organization to start with; the sense of hearing must be acute. The accomplished operator often reads the message by the mere "click" of the machine, without even looking at the visible signs which are produced upon the slip. Great manual dexterity is indispensable, and consequently the hand especially needs to be thoroughly trained. It might be supposed that the more delicate organization of woman would give her a marked advantage over man in this avocation; but experience has not thus far justified this anticipation: the best female operators, we are told, do not equal in efficiency the average of males.

It is quite certain that the telegraphic business will be extended in a ratio much greater than that of the increase of population, and there is no reason to anticipate that the supply of accomplished operators will exceed the demand for their services. So much depends upon the accurate performance of their duties, that the few great telegraphic companies who have absorbed nearly the whole business cannot afford to employ any but the most reliable operators, and the probability is that their salaries will increase rather than diminish. It is, therefore, an avocation which commends itself to the consideration of those who have the requisite mental and physical qualifications for pursuing it.

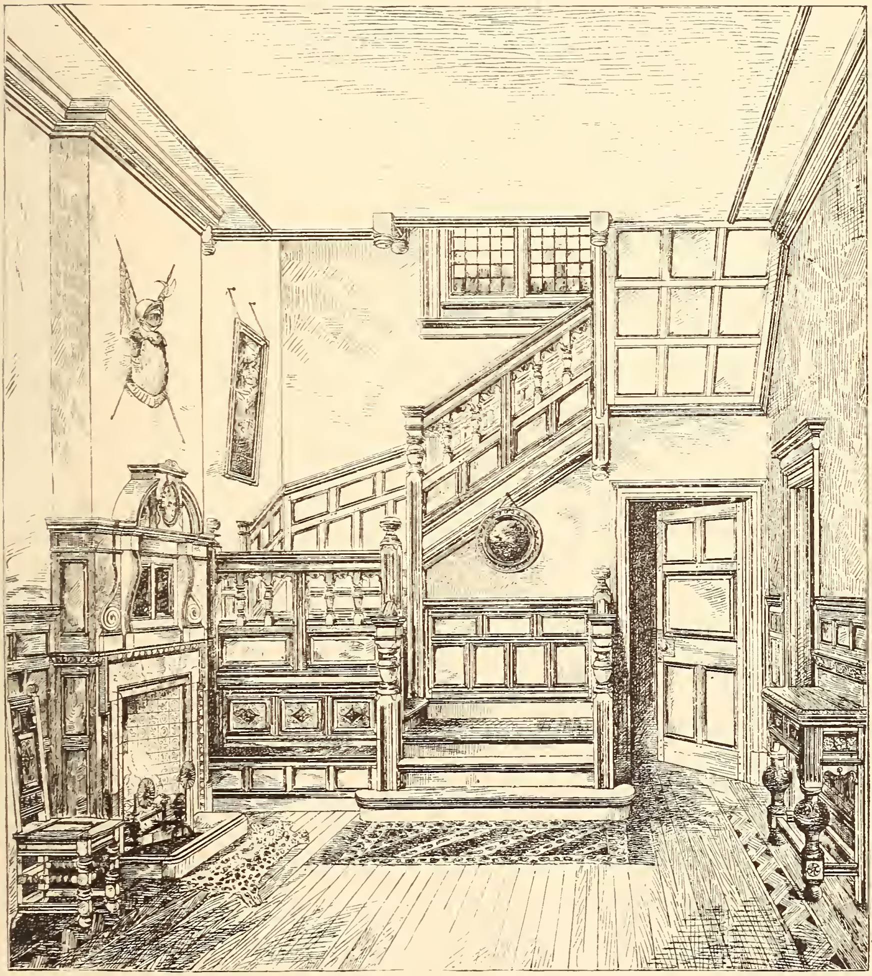
CHAPTER XXIX.

GENERAL REQUISITES FOR MERCANTILE SUCCESS.

WHILE it is no doubt true that a very large proportion of those who have attained competence and wealth have done so in some of the various departments of commerce and trade, it is equally true that the proportion of those who fail in doing this is greater than in almost any other department of enterprise or industry. To be assured of this, one needs only to read over the regularly published lists of bankruptcies, or to call to mind those within his own personal knowledge who have "failed" in business. But we have always before our eyes those who succeed, while those who fail of success are apt to pass from our remembrance.

The undeniable truth is, that the mercantile profession has become, more than almost any other, overcrowded; and this for many reasons. To a person of an indolent nature it seems a much easier thing to stand behind the counter and sell something which another has made than to make it himself. Then, again, it has come — perhaps we should say *had* come — to be looked upon as more "genteel" to buy and sell than to produce. A salesman in a shoe store was looked upon as in some way superior to a shoemaker. The son of a farmer was too apt to grow weary of farm-life, and to hire out as a clerk in the neighboring village, with the purpose of "setting up a store," in time, upon his own account, or to betake himself to the city to seek his fortune. A few who had special gifts for trade — and perhaps special opportunities — succeeded, and the success of every fortunate one was proclaimed upon every house-top in the neighborhood from which he had migrated. And, moreover,

FRIEZE: THE LADY OF SHALOTT.



HALL AND STAIRCASE.

See Note 25.

there was a lurking idea that little more was needed for a trader than to be tolerably well-looking and well-mannered, and to have a fair share of "gumption."

Through these and many other causes business has been overdone everywhere, and most of all in the great cities. Only a small proportion of the "clerks" of whom one catches a glimpse through the shop-windows can, in any case and at any period, go into business for themselves; and these chances are growing notably fewer and fewer in comparison with the increase of population. The constant tendency is towards the concentration of trade in fewer and fewer hands. Only a certain amount of goods of any kind can be sold in any locality; and one great establishment which absorbs the business once done by ten, does it by superior ability or greater capital; for this, whether we regret it or not, there is no remedy. Customers will go where they are most likely to find what they wish and where they can buy cheapest. The proprietor of the great store has four advantages over his more humble competitor: 1. He will likely be a better judge of what will suit the tastes or needs of his customers. 2. He can offer them a larger assortment from which to choose. 3. Purchasing in larger quantities, he can buy cheaper. 4. His sales being so much larger, he can afford to sell at a less percentage of profit, and so more cheaply.

Most persons who begin as clerks must remain so, and there are really few more hardly worked or more poorly paid than clerks in a city store; and yet in no employment is there a greater proportion of applicants for "situations." If a man advertise for a clerk or a book-keeper he will be overwhelmed with answers. If he advertise for a workman of any kind the answers will be much fewer. This shows clearly that there are many more fairly competent clerks and book-keepers than there are situations for them to fill.

Still there are and will be, as there have been, not a few successful merchants and traders; and some of the chief requisites for success may be pointed out. First and foremost we place honesty. Credit is the very life-blood of trade. No man can reasonably attain permanent success as a merchant unless his word is as good as his bond. He needs to be in good credit, not only with those from whom he buys, but with those to whom he sells. Indeed, of the two, the latter is of the greater importance. He should so conduct his business that his representation shall be held as a sufficient guarantee that his goods are just what he sells them for; and he can gain this only by making himself well acquainted with the articles in which he deals. If he buys poor wares he cannot sell good ones. His first business is to study the markets—both the buying and the selling ones. He must sell cheaply if he is to sell at all; and if he buys dearly he cannot sell cheaply, except at a loss.

The successful merchant must be sagacious and forecasting—he must not take it for granted that because some particular kinds of goods which have been and are in demand will continue to be so; the more especially is this the case in respect to articles the demand for which depends, to a great extent, upon the changes and caprices of taste and fashion—otherwise he will some day find his warehouse filled with unsalable goods. He must forecast the changes in taste, and be ready to meet them, not waiting to find them out by sad experience.

He must be enterprising, but his enterprise must be governed by discretion. He must not assume that because business is good this season it will surely be so the next. If he sell a part of his stock for less than it costs him, that loss comes out of the profit on the remainder. If he sell at cost, so much of his business brings no profit. It is better to sell a little less than he might have sold than to buy a little more than he can sell. In the one case he loses only the profit which he might have made; in the other case he loses the entire cost of what he cannot sell at all. The loss upon one piece of unsold or unsalable goods will counterbalance the net profit upon many pieces which have been sold. But he should steer clear of the other extreme. He should not assume that because the last year was a dull one, the next will be like unto it. He should compare the present with the past one, and from the comparison judge of the future. If the present be better or worse than the past one he must search for the cause of the change, in order to ascertain whether they are temporary or permanent.

This inquiry will not unfrequently take a wide range, involving the whole scope of production, finance, and even of party politics. The demand for all goods varies with the general condition of the country. If the labor market is disturbed, if there be "strikes," say among the iron-workers of Pennsylvania, these workmen earn less money and so have less to lay out for clothing; the manufacturers sell less of their goods, and begin to produce less or reduce the rates of wages; the operatives, earning less, have less with which to buy the products of others, and so on. If the harvest be bad, the farmer has less grain to sell and must buy less of manufactures. A drought in the grain-fields of Kansas or Illinois is felt in the mills of Lowell, in the founderies of Pittsburg, and behind the counters of New York. It stands the merchant in hand to keep his eye upon all these things. He has as much to do as any other man can have with the movements of "the trades," the weather-reports of the Signal-office, and the bulletins of the Agricultural Department. Dry reading enough they may seem to be, but he will soon find them "interesting" to him in more senses of the word than one.

And, finally, the merchant, if he be a wise man, will maintain a due relation between the business which he undertakes and the amount of the capital which he can command. It matters not whether this capital be in money of his own or in credit, or, as is most likely to be the case, partly in both. Many a merchant has become bankrupt, losing in the end hundreds of thousands of dollars, simply because at some critical and unexpected moment he could not at once command a few thousands to meet his current engagements. Assignments and receiverships, even when they are expected to be only temporary, will speedily eat up a great estate. A forced closing-up of any business will be pretty surely a losing one.

"But," it may be asked, "must a young man never enter upon mercantile business unless he have a capital already secured?" To this we answer, Yes or No, according as the word is understood. Capital he must certainly have, of some sort, but that capital may consist not in cash, but in credit — that is, not in what he actually *has*, but in what he can *do*. It may consist in unusual mercantile knowledge and capacity, added, of course, to recognized integrity. It may, and often does, consist in his being a perfect "judge" of some important article.

We have in mind a young man who has just been invited to a partnership in a large importing house where he had been a clerk. Their business consisted in importing a special article of manufacture produced in Germany. One day, not three years ago, his employers told him that they wished to send some one abroad to purchase these goods and to arrange for the manufacture of particular styles for their exclusive use. "If you only understood German," they said, "you would be just the man." To their surprise, the answer was, "Oh, I speak German." The fact was that, six months before, he had learned that the firm had such a project in mind, and he set himself down to learn German, devoting to it every spare hour. He was sent, and acquitted himself so successfully that he went again the next season. Upon his return the firm, knowing his value and being quite sure that others in the trade would soon find it out, offered him a partnership, although he had only a few hundred dollars which he had saved from his by no means large salary. His special knowledge of a single article was a full equivalent for many thousand dollars in cash.

Of course such young men are not very common, and perhaps it is not often that such an opportunity offers itself. But, after all, we fancy that such possible opportunities are less unfrequent than are the men capable of anticipating them and prepared to seize upon them when presented. Good roads leading to success outnumber the men who can be found to travel on them.

Thus far we have chiefly considered the ways to success in life which are or may be traversed by great numbers. We have taken up, one by one, the prominent occupations, and have endeavored, by a copious array of statistics and figures, to show what is the present condition of these industries as compared with the past, and what may be reasonably anticipated of their prospect in the years to come—where they can be most successfully carried on, what are the present and prospective pecuniary inducements which they offer, and to indicate in a general way the essential personal requisites for at least fair success in each of them. The general conclusion from this wide survey is, that in this country, as it is, and as it is likely to be for many years to come, every man of good physical constitution and fair intellectual capacity may, by industry, prudence, and forethought, secure all the comforts of life and not a few of those conveniences and luxuries which were in by-gone ages attainable only by the comparative few, and this within the beaten tracks of avocation and employment.

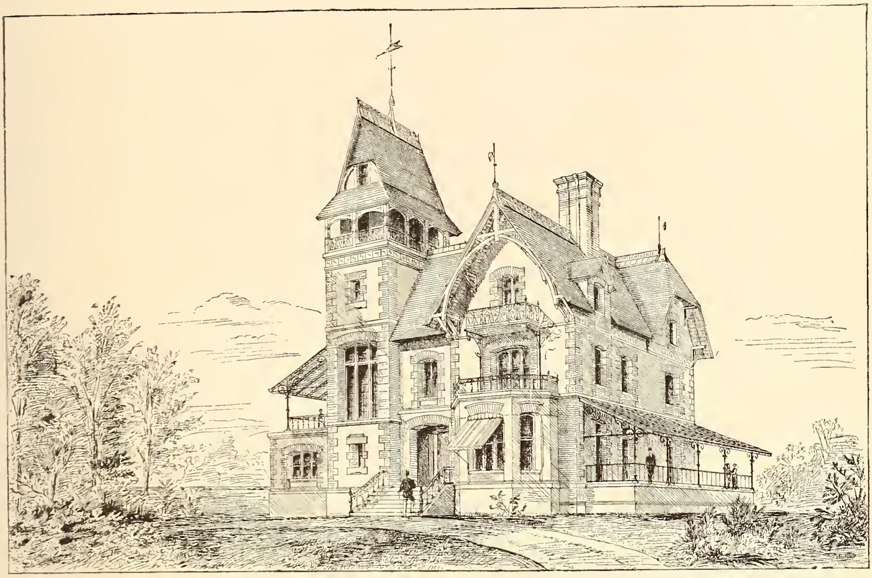
But there are still higher summits of success in life to be reached through those narrower paths, which can be traversed only by those who have natural or acquired faculties of a higher order than are possessed by the average of men. These paths to high success often run side by side with the well-trodden ways, or are a continuation of them, beginning where the others leave off. A few of these we shall proceed to point out with some detail in succeeding chapters.

CHAPTER XXX.

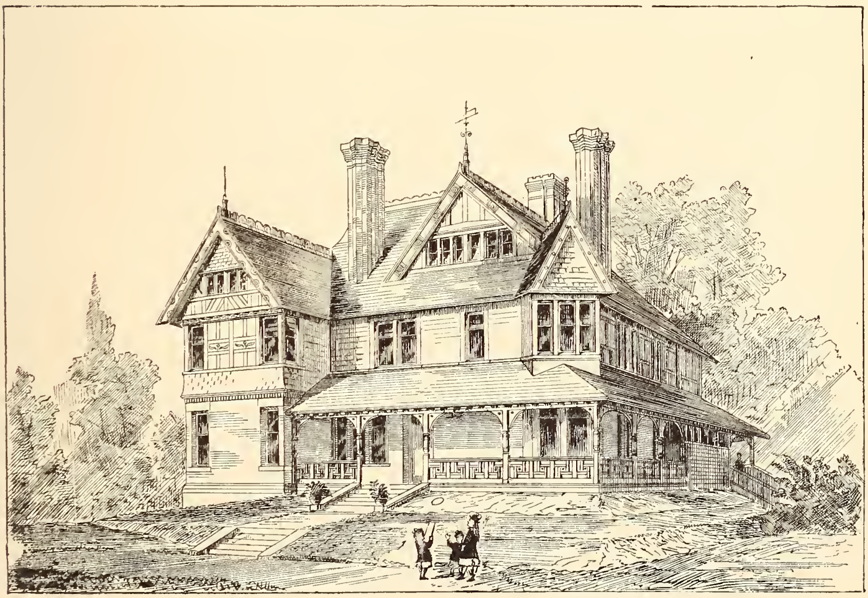
HOUSE-BUILDING AND ITS OPPORTUNITIES.

SOME limit the term "architect" to those who design and construct costly and ornate buildings—public or private—temples and state-houses, palaces and mansions. We style every man an architect who plans and erects any building, for human use and occupancy, in such a manner that it will, in a good degree, subserve the purposes for which it was designed. For competent architects of every class there is a wide and ever-widening field among us; of incompetent ones there are enough and to spare. We have costly churches, court-houses, and public halls built with such disregard of the laws of acoustics that the voice of the speaker can scarcely be heard by half the auditors. A public building or school-house capable of being properly warmed and decently ventilated is rather the exception than the rule. To find a great public building in which the space within the walls is fairly utilized, one must look far and wide. If one is in search of glaring examples of all these defects he need not look farther than to the New York Custom-house, Post-office, or City Hall. If it had been the purpose of the architects that the occupants of these buildings should be half-frozen in winter, half-roasted in summer, and half-stifled at all seasons, they could hardly have done more than they have to accomplish their designs.

Nor is it much better with our dwellings. In cities especially, what with architects and plumbers, few even of the most costly dwellings are fit for human occupancy. Foul exhalations from the sewers pollute the most gorgeously furnished parlors, dining-rooms, and bedrooms. The architect has thought mainly



MODERN DWELLINGS. DESIGN NO. I.



MODERN DWELLINGS. DESIGN NO. 2.

See Note 26.

of producing what he considers a handsome exterior, and the interior arrangement has been little cared for. Windows have been put where they were thought to give a picturesque aspect to the house, with little care as to whether they would properly light and ventilate the halls and rooms. The plumber has so fitted his pipes and traps that they will not do their work when in order, and will not stay in order at all. Nowhere is this worse than in our hotels, flats, and tenement-houses, where large numbers live under a single roof. Not a few of the most imposing "apartment" houses are only a little less faulty in these essential requisites than the poorest "tenement" houses. Diseases arising directly from malaria or foul air are rife among the very rich hardly less than among the very poor. Puny children are to be seen clad in velvets as well as in rags.

Bad architecture and imperfect plumbing work less evil in rural than in city dwellings, simply because the architect and the plumber have had less to do in their construction and fitting up; but it is rare to find a dwelling-house in a village or on a farm which is not wofully deficient. Where there is space enough and means enough so to build that all the apartments might be large and airy, the bedrooms are contracted into closets, and the doors and windows are placed with little care for the requirements of ventilation. "Any place will do to sleep in" has come to be an axiom in practice if not in speech. Nine-tenths of our population spend fully half their lives in-doors; a majority spend at least three-fourths of it thus, in their homes, their workshops, and places of business. Taking the seasons together, even the farmer is in the fields fewer hours than in the house.

No man who has ever built a house for his own occupancy but will confess that, were he to build again, he could do it better and at less cost. He has bought his present knowledge by experience, and at a high price. It would be better for him to buy the knowledge of others than to gain it by his own experience. Before he begins to build he should make up his mind pretty nearly as to what he wants, and how much he is able or willing to expend for it; then, if he is wise, he will call in an architect—if he can find a competent one—to carry his wishes into effect. Most probably the architect will tell him many things of which he had not thought. Some of his own objects may be impracticable, some not desirable, and for some, though good in themselves, better ones may be substituted. A man may know very well what kind of coat he wants, but he will get one more to his liking by employing a tailor than by trying to make it for himself. So he may know what he wants in a house, but a competent architect will carry his wishes into effect much better than he could do it himself. Of course it is better to employ no architect at all than to have an incompetent one, just as it is better to have no physician at all than to call in a quack.

As we grow in wealth we require more of comfort, convenience, and elegance; and as we become educated we look more judiciously for the means of supplying our wants. Nowhere is this more apparent than in providing better homes. Everywhere there are men who want houses better planned, as regards their comfort, convenience, and health, than they themselves can design or build. This long-felt want is only partially met by books upon domestic architecture, although some of these are of decided value. But the best book can give only general hints and indications. There are still wanted practical architects, who can adapt these hints to individual cases, and supply others to meet special conditions, and who, more than all, can carry out these conceptions in brick and mortar, stone and wood, according to all the varying conditions of site, climate, and material to be used. We have an American climate, American building materials, varying in different sections, and American habits and modes of life. We may, if we please, construct our churches and public buildings after models which have come to us from other times and other lands; but we need, and in time shall have, a distinctive domestic architecture, varied in details to suit the various sections of our wide land. And for this architecture there must be architects who have learned not only what is to be done, but how to do it.

Very much is required of such an architect. It is not enough that he shall be able to draw a design which looks well upon paper, with its pretty windows and oriels, its porches and verandas, its picturesque roof and chimneys. The windows must not only be capable of being opened and closed, but they must be so placed as to give light and air to the rooms —they are for the rooms, not the rooms for them. Picturesque roofs should be discarded if they will not shed rain and snow, for usefulness should not be sacrificed to neat appearance. Beauty is useful in and for itself, and that beauty which results from harmony of proportion is attainable in the humblest as well as in the most pretentious dwelling. An ugly design is all the uglier the larger the scale upon which it is carried out. Many a design which pleases the eye is displeasing when rendered into stone or brick or timber.

Things which are to be used are beautiful only when they serve their uses. A monument is made only to be looked at; a house is made to live in or to work in. Every building should therefore indicate by its very exterior the purpose for which it is to be used. A handsome church would be an ugly dwelling-house; a school-house would be an ugly one if it looked like a manufactory or a warehouse. A dwelling should be adapted to the climate. The steep-pitched roof adapted to the snows and rains of Vermont would be useless in California. The broad, encircling verandas of a Mississippi dwelling would be out of place in Maine.

The materials of which a house is to be built must modify nearly every detail of the construction. One design can be well carried out in wood, and not in brick or stone; another in brick and not in wood. Probably stone will be used to any considerable extent only in public buildings and large mansions. Country dwellings, in many districts, may continue to be mainly of wood. In towns, and in those sections of the country where lumber is becoming dear, brick will be the usual material; but whatever may be the material, the house should never be made to appear other than what it is. Nothing can be more absurd than to paint a brick wall and mark it off into squares to simulate blocks of stone. No eye is deceived by this, and every eye instinctively protests against any attempt to cheat it.

It is a comparatively easy task to plan a house for an equable climate, for there are only one set of conditions to be taken into view. But in a very large part of the United States the winters are almost arctic and the summers almost tropical; and if the house is to be occupied as a permanent residence all the year round it must be adapted to both extremes of weather, as many things desirable in one season would be objectionable in the other. The broad verandas, so cheerful in the Gulf States, are no less pleasant in a New England summer; but nothing is more cheerless than such a veranda when the dead leaves of autumn cover it, or when it is heaped up with the snows of winter. On the other hand, the contracted windows and doors and passages which winter comfort suggests would render the house close and uncomfortable in summer. The small sitting-room, which has so cosy an aspect at Christmas, becomes almost unendurable in midsummer. The architect who plans a dwelling to be lived in all the year round must compromise between what he would have done had he been planning only for summer or for winter, the features most appropriate for either predominating according as the summers or winters predominate during the twelvemonth. Any man may have a summer suit and a winter suit, but few can have a summer house and a winter house: one residence must do duty for all seasons. Common-sense lies at the foundation of all true architecture.

The color of a house has not a little to do with its attractions. Nobody, of course, would dream of painting a stone house, but would leave it of its own natural color, whatever that might be: a few years' exposure to the weather will tone down the color of any stone to a pleasant tint. To paint brick is hardly less absurd. It is generally assumed that a dwelling of wood should be painted for the sake of preservation, but there is far less advantage in this than is generally supposed. Painting may cover up bad material, but will not make it durable. If any part of a building needs protection it is the roof. Mr. Holly, an excellent architect, says: "Although painting is used to protect the shingles against the weather, it in reality promotes their destruction; for the shingles, in their natural state, allow the water to run free, whereas paint fills up the cracks or watercourses, and forms ridges which prevent its escape; consequently it remains in the wood." If this be true of the roof it must be no less so with the walls. But painting is commonly used for ornament. The same writer also says: "Shingles, if left to themselves, will naturally assume a color which improves every year by exposure, while paint not only appears unnatural at the outset, but looks worse and more rusty as each season passes." This, too, is as applicable to boards and joists as to shingles. The unpainted, boarded walls of a house will gain a pleasant color by time as well as its unpainted, shingled roof.

But if paint is to be used, the color should be judiciously chosen, and the architect should make the color a part of his design. If he have an educated eye he will set himself firmly against white, which is always glaring and makes an ugly spot in the landscape. Any one of a hundred warm tints — neutral, not positive — may be chosen; say French gray, buff, olive, or a delicate shade of salmon. Next to white the kind of dirty yellow so prevalent a few years ago is to be tabooed. For the common use of this color that very clever landscape-gardener, Mr. Downing, must be held responsible. He said: "Pluck from the ground the roots of the grass, and the color of the earth thereon should be the color of the house." His disciples took him at his word, and covered the country with their mud-colored structures. The color was ugly, and everybody felt it to be so, Mr. Downing to the contrary notwithstanding.

Whatever be the material or color, no wall should present an unbroken mass of tint; the trimmings should be darker than the rest, but there should be no startling contrasts. More than is generally conceded rests upon the external color, and the architect should not leave the selection of it to the house-painter. The color of a dwelling is in itself of minor importance, but upon it depends very much the general impression which the house makes upon the spectator; and a building which makes a pleasant impression at first view is the best advertisement for the architect.

The foundation and the roof are points which call for the utmost care of the architect. The best edifice raised upon a bad foundation will soon go to pieces, and no house with a leaky roof can be a habitable one. The roof, moreover, is, more than any other part, exposed to the rough usage of the elements —to rain and snow, to winds and sun. Hardly less important in a cold climate is the chimney. Smoky chimneys may be fairly counted among the minor miseries of human life.

But the sphere of the architect lies quite as much with the interior as with the exterior of the house. In the country or in a village, where there is ground enough, the architect has much scope for choice in the matter of site and exposure, and he may gain the required interior room by merely enlarging the ground-plan; but in a city, where the plot is necessarily limited, he works within narrower limits. Upon a rectangular lot, the length of which is four or five times its breadth, he has to construct a house covering as much of the area as is any way consistent with leaving a "yard" large enough to admit air and light from the rear — light and air can be admitted only by windows in the narrow front and rear. Three stories, including the dormer roof or attic, are all for which provision need be made in a rural house; twice or three times as many are becoming the necessary rule in most of our large cities.

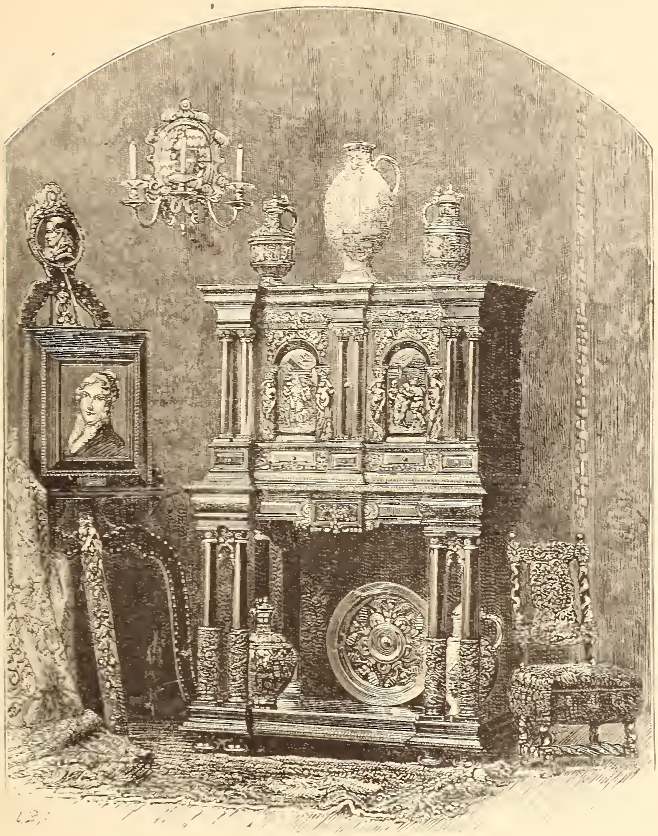
The deficiency in the quantity of light which can be admitted through the windows possible in such a front and rear may be partially made up by gas-light, but there must be further provision made for ventilation. As the vitiated air cannot be adequately carried off through the walls, vents must be made for it through the roof, and mainly through the chimney. It has come to be an axiom among all who have given attention to sanitary science, that, in a city house at least, no room is fit for the occupancy of a human being — whether for living, working, or sleeping — which has not a chimney-flue kept open all the while. These chimneys and their flues must form an integral part of the house. If they are badly planned, the fault is well-nigh irremediable. A proper chimney-cap will make a good chimney better, but the most scientific cap cannot make a good chimney out of a bad one. Chimneys and flues may be regarded as the crucial test of the ability of an architect. If his plan is deficient here the fault is all his; whereas, if the plumbing does not come up to the standard the fault may, in part at least, be shifted upon that convenient scapegoat, the plumber, who in any case has enough sins of his own to answer for.

In most European cities the use of gas is almost unknown in private houses, and the water-works are not contrived so as to introduce constant running water into the various apartments. The contrary is the rule with us. Our mode of building also makes it almost universal that the privies and water-closets should be a part of the house, and under the same roof. In a very large proportion of houses these indispensable adjuncts are located, one over the other, in the successive stories or flats, and not unfrequently without due provision for discharging the exhalations. The capable architect will always place this structure at the rear end of the building, so that every closet shall have a window opening into the outer air. In any case, a ventilating shaft from top to bottom should be held absolutely indispensable. The architect should regard the plumbing of a house as one of the most essential parts of his work, and the client, if he be a wise man, will leave the direction of this to him.

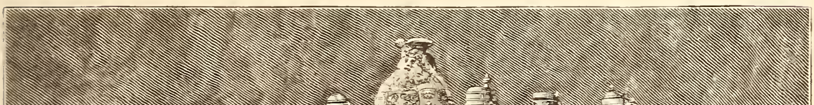
One of the most important parts of an architect's duty is to estimate the cost of carrying out his design. The conscientious architect will ascertain as nearly as possible how much his client is disposed to lay out upon his house, and will work out the design accordingly. A man who has only five thousand dollars to lay out upon his house does not want a ten-thousand-dollar design. In many cases, and in large towns most frequently, the actual work of building will be done by contract — most likely by different persons: the mason-work by one, the wood-work by another, the plumbing by another, and so on. If one of them fails to do his part at the time fixed upon, the others, in their turn, will be behind time. The architect must draw up the contracts in such a manner that each of them can be properly executed in accordance with its terms. If his client fails to get his house properly built, and in a proper time, it will be small satisfaction to be able to learn whose fault it was. The duties of the architect thus involve a knowledge of many specialties. He needs to be an artist, an engineer, a sanitarian, a lawyer, and, as a prerequisite to all, an honest man.

Now, will a profession pay which makes such large requirements? The question resolves itself into another: "Is there now, and is there likely to be in the future, a demand for this kind of work?" The statistics which are scattered all through this volume give a direct answer to this question. Not only is the country, as a whole, growing richer, but the number of persons who pass from straitened circumstances to competence is increasing rapidly from year to year. The man who five or ten years ago broke the virgin sods in Iowa or Kansas, or started an orange-grove in Florida or vineyard in California, is to-day a thriving farmer. His requirements for home comforts have kept equal pace with his means of gratifying them. He has not lived all these years shut up in the cabin which he hastily put up. He has read books and periodicals, which tell him of a home for himself and his family quite different from that which he occupies. In his journeyings he has seen many such homes, even if only in passing by them on the railroad. He perceives, also, that to build such a dwelling requires a knowledge and practical experience which he himself has not acquired, and probably could never acquire; but he has learned, also, that there are men whose aid he can command, who can do for him just what he wishes done, and the nearer an architect is to him the sooner will he be likely to make requisition for his services.

Again, the whole of that vast region, so varied in its resources, which we denominate "the South," has entered upon a new stage of development. More Southern men than ever before go North, with eyes open to see whatever of good may there be found. More men from the North and from Europe seek homes in the South, carrying with them the ideas of their former homes. In an early chapter of this volume the characteristics of this interstate and international migration, as shown by the Census of 1880, have been set forth. The next Census will tell



EBONY CABINET.



CHEST IN CARVED OAK, INLAID WITH COLORED WOOD. NORMAN WORK, 1550.

See Note 27.

a quite different story. The North will have far more emigrants from the South; the South far more emigrants from the North and from Europe. This interchange will be of advantage to both sections, but, in a material point of view, most especially to the South.

The domestic architecture of the rural districts of the South will be quite another thing than it has heretofore been. And, moreover, the South is coming to be far less exclusively rural than it has been. The great plantations, each an almost isolated community, are breaking up into farms; hamlets are growing up into villages; villages into towns; towns into cities. Manufactures are springing into life. The Lowells and Manchesters of Massachusetts and New Hampshire will soon have their counterparts and rivals in Georgia and Alabama. City life will of course demand an urban architecture in the South, as well as in the North and the East.

Architecturally, the South is as yet a new country; but in the sections which are older in this respect the demand for competent architects is by no means fully supplied. The truth is, that the greater part of our city buildings have been flung up without any competent architect, and the extent to which they are now being demolished evinces that their tenants and owners are becoming aware of their defects. Owners of property have begun to find out that it pays to build dwellings with some regard to the convenience and health of their occupants, and that this cannot be done except by the aid of an architect. The growth of knowledge in this respect has increased the number of architects, but in nowise in proportion to the call for them. Every really good building which is put up is an incentive to the erection of others; and the improvement in architecture, strictly so-called, opens up avenues for success in other occupations connected with the economy of domestic life. Some of these we proceed to point out:

"There is no great smoke without some fire," and "any stick is good enough to beat a dog with," are two proverbs which should be read together. The plumber has come to have a bad name among all owners and tenants. He could not have got such a name without having measurably deserved it, and now that he has got it he has to bear the blame of many things that do not belong to him. It cannot be denied that there are few departments in which so much scientific knowledge and practical skill is required, and in which so little has been called into practice. It must be borne in mind that it is not fifty years since gas was first introduced as a means of lighting our houses, and not much more than half as long since water-pipes were at all common even in our city houses. Before that time architects had no occasion to take these things into account. The laws which govern the distribution and permeation of gases were practically unknown, for no one had any occasion to study them. That water in a pipe would rise to the level of its source, and would run off if an opening were made for it, was about the sum of the hydraulic and hydrostatic knowledge of the day. It is no wonder, when this principle had to be practically applied in the thousand forms now demanded, that the grossest mistakes were common.

We have insisted that the architect should take the whole matter of plumbing into the most careful consideration when making his design for a house. There is all the more need that this work should be faithfully done, because nowhere else is defective material or bad workmanship so hard of detection. A leaky joint or a flaw in a gas-pipe may not be found out until the whole apparatus has been put in operation, and not unfrequently the evils are of such a nature that they are discovered only when too late. Bad plumbing must, under all circumstances, occasion expense and inconvenience, but its mischiefs lie far deeper, involving disease and death; and not unfrequently the cause of the evil is never suspected until its fatal consequences have appeared. Not a few of our most imposing residences are pervaded by the most offensive odors. Recourse is had to perfumes and fumigations, but these are wholly useless. The fatal effluvia are not destroyed by overpowering them by any perfume. Disinfectants, such as chloride of lime, carbolic acid, and iodine are not without their uses; and in some cases, as in hospitals and sick-rooms, they are indispensable for temporary purposes. But the necessity for their use should be reduced to the lowest possible limits.

It should never be forgotten that disinfectants are only expedients to meet a temporary and local emergency. Nothing will effectually remove the evil from a dwelling except you remove the cause, and this deep-lying cause will always exist so long as the practical plumbing of our houses is left in incompetent hands. The trade of the plumber should be elevated into a profession. No person should be allowed to act as a master-plumber until he has passed a successful examination as an engineer. There is as much need that plumbers and gas-fitters should be licensed as that apothecaries should be.

Practically, the arrangement of the heating apparatus of a house comes within the sphere of the plumber, and in large buildings it requires a great amount of scientific skill. When there is a steam-engine belonging to the establishment, the exhaust steam, after having performed its office as a motive-power, offers a ready means for the solution of the problem of heating. Steam-coils, properly distributed, are beyond question the best mode of heating where they can be put in use, but the system is so costly and complicated that it can be employed in only exceptional cases. It will find place in comparatively few private dwellings. The number of persons who will find lucrative employment in this direction will always be limited, although the few who succeed at all will attain high success.

There has been a general and persistent decrial of the hot-air furnace. The main objection urged against it, which virtually includes most of the others, is that the heated air which it delivers is deprived of its moisture, so that it becomes unfit for respiration. The attempt to obviate this by placing vessels of water in the room to be heated is altogether inadequate; but a competent plumber will so arrange the furnace that the heated air shall pass over a water-surface of sufficient area to impart to it the requisite degree of moisture before it is delivered from the register. The advantages of a properly constructed furnace are obvious. It is really only a close stove upon a larger scale, and so located that the heat produced by it can be utilized to advantage. The halls of a large house can be kept at a temperature not greatly below that of the inhabited rooms, so that one need not pass at once from a tropical to an arctic climate. Colds, and the long train of diseases springing from them, are occasioned not by the absolute temperature to which one is exposed, but by the sudden passage from one degree to another greatly different — it matters little whether from a cold to a warm or from a warm to a cold one. It requires much less fuel to supply one furnace than to keep up a number of stoves throwing out an equal amount of heat; and, moreover, all the heat can, when desired, be directed into any part of the house. The furnace is an adjunct to the open grate, not a substitute for it. The architect who plans a house without providing for the warming of it, and the plumber who does not know how to carry out the plan, are alike incompetent for their work.

CHAPTER XXXI.

HOUSEHOLD DECORATION AND FURNITURE.

A VERY excellent periodical has for its motto "Take care of the Beautiful, and the Useful will take care of itself." This seems to imply a distinction which we by no means admit between what is useful and what is beautiful. Whatever gives innocent pleasure is in itself, and for that very reason, useful, and just in the proportion that it gives pleasure. A picture is as truly useful as a mirror. A tastefully decorated house is much more useful than one untastefully furnished, although it should afford the same amount of shelter from the elements. The man who can best minister to the sense of the beautiful is the one who will meet with the highest pecuniary rewards. We propose to present some practical suggestions on this topic as applied to house decoration as distinguished from architecture.

A pleasing arrangement of colors and forms is an important element in the pleasure which we derive from the most common surroundings of our daily life. If the walls of our chambers are of a gloomy color, they fill the rooms with gloom. If they are of garish or discordant colors, they act as a perpetual irritant, although we may be hardly able to tell why. Wall-papers afford a ready means of securing the result at which we aim in this respect. When we look at the kinds of paper which arrant stupidity inflicted upon us a few years ago, we cannot wonder at the revulsion which they excited. Anything—even a dead, unmeaning white—was better than that, and a slight, unvaried tint—blue, rose-colored, gray, or anything—was a positive relief. If they lacked something in pleasing, they were not positively displeasing.

But now we are not driven to the alternative of choosing between hideous wall-paper and none at all. True artistic taste and skill have been brought into play and have given us a wide range for selection. The designing of patterns for wall-paper has grown into a profitable branch of artistic industry, well worthy the consideration of those who are endowed with the requisite capabilities; and so wide is the circle to which they address themselves that there is little fear that the paths of real merit will be overcrowded. There is inexhaustible scope for variety. No person of cultivated taste wishes all the rooms of his house to look alike. He feels instinctively that what best befits a dining-room does not best suit a parlor or a bedroom. He does not even wish all his bedrooms to look alike. It is becoming more and more usual to vary the aspect of the wall surface by breaking it up with a frieze at the top and a dado at the bottom, with an interspace between; charming contrasts and harmonies of color may thus be attained. Thus the dado may be of an arabesque pattern in chocolate, relieved with darker shades—even with black, or black and gold. The frieze may be a running pattern in quite brilliant colors—say a vine and trellis-work in green, with red or purple or golden fruit; or it may represent a series of living figures, as if moving in long procession around the apartment. The intermediate space, or wall proper, may be treated in a hundred effective modes, but should always be less decided in tone than the frieze and dado. It cannot be denied that there is a tendency among artists to render these patterns too intricate, so that the eye wearies itself by attempting to follow the interlacing lines of the pattern. For a bedroom, where the cardinal idea is that of repose, simplicity of pattern should be sought for. Pictures show best against a light background, furniture and dresses against a dark one. So in a parlor, if there is to be any difference in tone, the dado should be darkest, the frieze the lightest, and the intermediate space of a general, neutral tone between the others.

The ceiling is usually the most neglected or the worst abused part of the room. Plain whitewashing is perhaps the most common mode of treatment. In a sleeping-room the eye rests upon this quite as often as upon any other portion, and a dead white is more wearying to the eye than any color. If the ceiling is to be perfectly plain it should have some soft tint: a delicate blue, or rose-color, or a faint green are all unexceptionable. The other extreme is to overload the ceiling with heavy panellings and mouldings in plaster, which always look as if they were about to tumble down, and not unfrequently do so. Even worse than this is an exaggerated frescoed imitation of such work. A thing bad in itself is not so bad as a poor imitation of it.

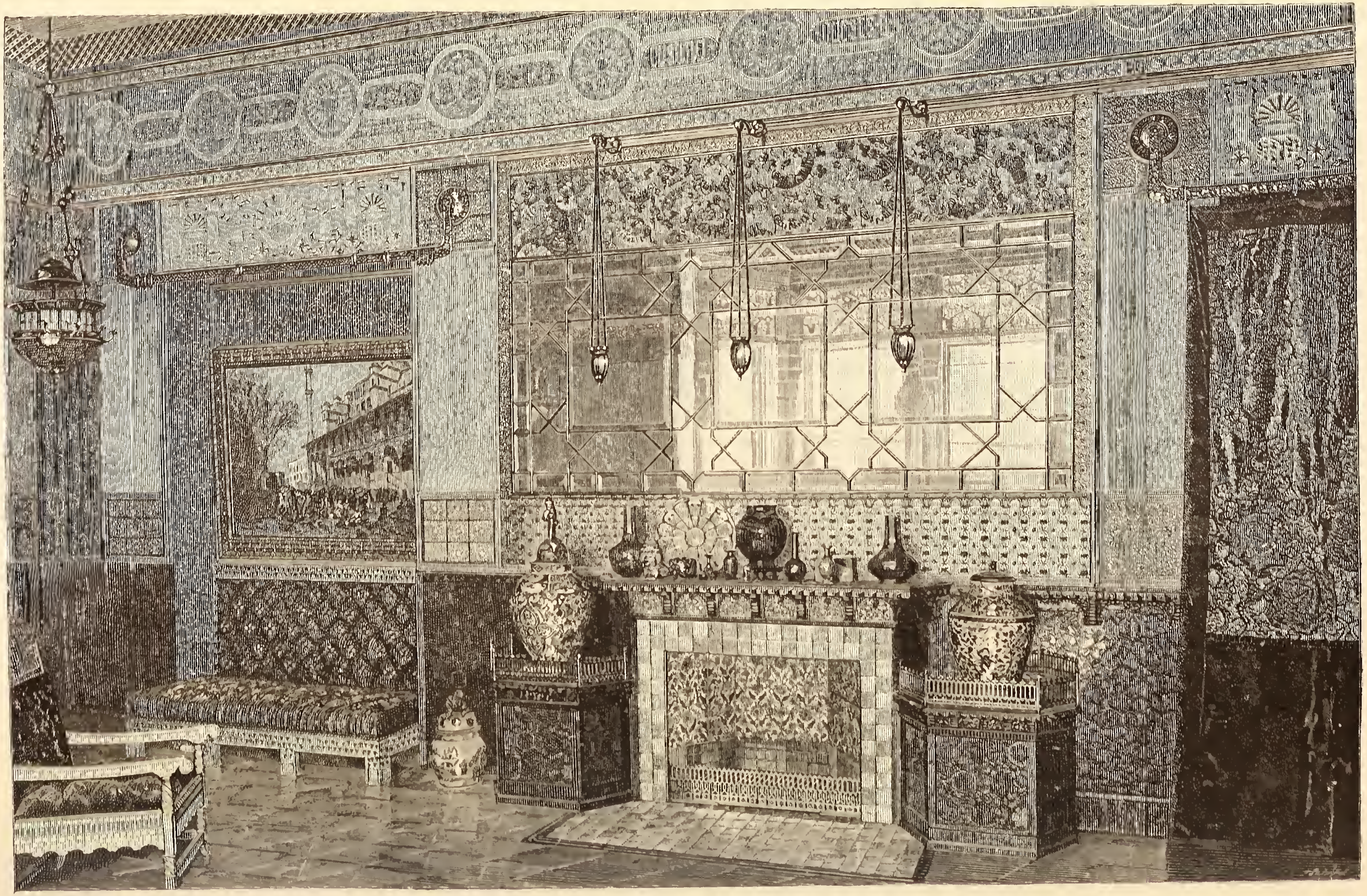
But the ceiling need not be undecorated. Indeed, there is no other portion of the room which is more susceptible of ornamentation, or which requires it more. The walls, if left plain, must be broken by windows, doors, and fireplaces, and may be relieved by pictures, and the floor by furniture; but the ceiling presents an entire surface visible at a glance. A flat design in color may be the leading feature, reaching to within a few inches of a border which surrounds it like a frame. Natural foliage is always appropriate for walls and ceilings, but with this difference, that in walls the plant should be viewed from the side, and have an upward direction, while for ceilings and carpeted floors it should be represented as lying flat or trailing.

All the effects of which we are speaking are produced by color. Nature is the great colorist, and we have only to reproduce, on our small scale, the happiest effects of what she has done on her large scale. Thus, the roots and trunk of a tree are dark; the branches are clothed with foliage, rarely of a very pronounced color; the blossoms, of all gay and bright hues, belong to the top. The tree corresponds to our room, with its dark dado, its middle-tinted wall-space, and its bright-hued frieze. Our ceiling represents the dome of the sky: blue, the color produced by distance and of itself giving the effect of distance, or with such other colors as the varying clouds assume. We may even go farther in our imitation of nature, and people our bright sky with flying birds or stud it with golden stars. All this pleases the eye and is true Art—indeed, it is true Art because it pleases the eye. Fortunately, we are not left, in decorating our ceilings, to depend upon the efforts of such painters as we may chance to find. Paper for ceilings is now to be had, designed and executed with as much artistic feeling as is shown in any other wall-paper.

The general effect of a room depends very much upon the way in which the windows and doors are treated. Their location and size rest with the architect as such; their coloring to the house-decorator. The architect may have done his part well, and yet, as far as beauty is concerned, the decorator may spoil it. It is quite common to see doors and windows with their cases and trimmings painted white, even when the walls are dark. Now these are the emphatic parts of the room, and should be darker than the general tone of the whole. The cornices, architraves, and other trimmings, moreover, have the effect of frames, and should be darker still, but yet not as dark as the dado or base. White should not be used at all, even for the sashes.

If there be any one thing upon which custom has set its sanctioning seal, it is that in a house of any architectural pretensions the fireplace should be of marble. Who ever saw a house advertised for sale or for rent in which "marble mantels" were not enumerated among the chief attractions? Marble finds its proper place in the interior architecture of churches and palaces, where, fashioned by the sculptor's hand, it fulfils true artistic conceptions. Wooden mantels satisfy the eye far better. Any one of our native hard-woods is appropriate: ash, maple, chestnut, or oak. A room otherwise in good taste is often spoiled by a mantel of white or black or variegated marble, or by some "marbleized" imitation, worse even than an imitation mahogany or rosewood door.

Carpets are the prevailing weakness of an American housewife. Whatever a woman may confess herself unable to do, it is not easy to find one who will endure even the hint that she cannot select a carpet. Possibly she may be qualified to do this, so far as quality is concerned; but the carpet is essentially for decoration, or rather it is the foundation upon which the other decoration rests. The carpet is part of the floor; it is to be trodden upon, and it should never suggest any unfitness for this use.



PARLOR DECORATION.

See Note 28.

This precludes all direct representations of fruits and flowers, of birds and beasts, of vases and medallions. A carpet of very light color is out of place and always unpleasing. The tone of color should be at least as dark as that of the darkest part of the walls, nor should there be any mass of color so decided as to force itself upon the eye. Perhaps the highest praise which could be accorded to a carpet would be that it was so exactly adapted to its place that one did not consciously look at it at all.

For many reasons, and especially for sanitary ones, it is to be wished that carpets were much less used than they are. For all situations, as halls and staircases, where there is much treading within a small space, they are out of place. At the best they hold dust, and are not easily kept clean, so that they are decidedly objectionable in bedrooms. It would be far better, instead of a carpet nailed fast and covering the whole floor, to have movable strips laid down before the fire, by the side of the bed, and in front of the dressing-table — that is, in the places most trodden upon. These could be taken up and swept in the hall or out-of-doors, thus doing away with a great deal of unnecessary dust.

It needs but little consideration to perceive that the occupation of house-decorator—call him joiner, upholsterer, or what one will — presents numerous openings for higher capacities than are required for the artisan or mechanic. The designing of patterns for wall-papers, for example, has long given very profitable occupation to many persons in England and France, and we are not now obliged to look abroad for this manufacture. We now produce it in every way as attractive as any which is imported; and the day, if not wholly past, is fast passing when it will be thought to be a recommendation of any article to say that it was produced in London or Paris or Berlin, rather than in New York or Philadelphia or Chicago.

The sense of the harmony of colors, which lies at the foundation of all decorative art, is common to most persons—so far, at least, that they can appreciate the result when they see it. To know how to produce this result is what distinguishes the decorative artist. He must originally have this faculty in a higher degree than is common, but having it in a good degree it may be cultivated up to any point. The man or woman who attains to this cultivation need not fear that he will lack lucrative occupation or that the field will be exhausted. Few persons ever saw a room so decorated that they wished for one exactly like it: they want one as beautiful, but yet different. As well might the author or painter fear that when he had perfected one great work there would be nothing more for him to do, because everybody would want that and need no other. The truth is, that everything well and thoroughly done causes a demand for something better, or at least different; and no one need give himself any fear that the end of advancement has come. The round earth may have its *Ne plus ultra!* but to possible human progress there is no finite boundary line upon which is inscribed "No more Beyond!"

Decorative Furniture.

By "furniture" we mean those appurtenances to a room which do not form a part of the structure, but may be removed from place to place in it, or from one apartment to another. The furniture of a people is an index to its domestic life; where this is universally scanty, or ill-adapted to its purpose, it is sure proof that the people have no homes in any high sense of the word. Their dwellings are merely sleeping-places, or refuges more or less temporary during inclement weather. The moment that a dwelling becomes a permanent habitation the occupants seek to make it attractive by furniture and decoration. The absence of furniture does not of necessity imply a state of barbarism. The Greeks of old were a very highly civilized people, but they were not a domestic people; they thought little of home-life, they lived out-of-doors, and while they adorned all public places with the grandest architecture and the noblest statuary, their houses were hardly thought of. Athens was a group of temples rising up from a mass of huts. The temples of the gods were not temples in our sense of the word—structures *in* which to worship—but monuments at which to look.

The Parthenon and the Erechtheum were merely dark chambers, surrounded and surmounted by gorgeous porticos and friezes. The Romans had more of the domestic feeling: their idea of woman, though far below that of the Germans, was far above that of the Greeks. The wife of a Roman was not merely his plaything, but was in a good degree his mate; thus, having a home of his own, the Roman set himself to render it pleasant.

Some of the excavations at Pompeii show what a refined Roman dwelling was. We can step into it to-day and see how it looked on that evening, eighteen centuries ago, when the fatal ashes from Vesuvius came down and buried it. Pity it is that these excavations also show another side of life, and reveal habits and manners from the very thought of which we shrink back. If one of our cities should be in like manner buried, and be exhumed after the lapse of two thousand years, though not a page of writing were found, the people of the thirty-ninth century would be enabled to gain a clear idea of the home-life of the people of the nineteenth century from the very furniture of their dwellings.

We propose to speak of furniture not—except incidentally—from an artistic point of view, but as furnishing means of profitable employment to those who produce it.

In our tables, chairs, beds, bureaus, household utensils, and the like, utility is the first consideration, beauty of form and color being a secondary one. A chair upon which one cannot sit with ease, a bed upon which it is torture to lie, a table which will not stand of itself and support what is meant to be placed upon it, a bureau the drawers of which will not open and shut, all violate the primary law of its being, and are fit only to be consigned to the fire, although all art-critics ring its praises and designate it by the loftiest of artistic names, or assign it to the most famous periods: Egyptian or Pompeiian, Gothic or Mediæval, Renaissance, Elizabethan, Louis Quatorze, Queen Anne, Eastlake, or what not.

Durability, of course, is essential to utility; so there must be sound materials and honest workmanship. The cabinet-maker has more opportunities than most men to slight his work. Paint and varnish and putty may be made to cover up bad wood and worse workmanship. It is inevitable that most of our furniture should be made in large factories, where machinery can be made use of instead of hand labor. The result should be better work instead of worse, as has been too often the case. We trust the time is pretty well over when the cheap and flimsy wares which have filled our furniture warehouses will find favor; but that furniture-buyers, like others, have discovered that nothing is cheap which is not good of its kind.

Beauty of material, form, and color is perfectly compatible with the perfection of utility, and there is a growing demand for both. Herein lie the opportunities for the attainment of that profitable occupation which we have in mind. The "Shaker" chairs found favor because they were really easy chairs, and were framed so as to hold together; men even perceived a kind of beauty in their intrinsically ugly forms. But we have come to perceive that ugliness is not essential to usefulness; that a seat may be as easy and as durable as a Shaker arm-chair, and as pleasing to the eye as anything which an Eastlake could design. Our great manufacturers have discovered that their customers have also found this out, and have seriously set themselves to meet and even anticipate the demand. The designing of furniture has already begun to be a profitable employment. The result is, that one can now purchase really beautiful and well-made furniture, from the simplest chair or lounge or table to the most elaborate bureau, sideboard, or bookcase, and at prices adapted to his means or inclination.

Earthen-ware, or pottery, in one form or another, enters largely into the furnishing of our dwellings. Our most common household utensils are made of burned clay; the most beautiful articles for the ornamentation of our tables and the decoration of our mantels are primarily fashioned from this abundant and cheap material, and upon this is often lavished the utmost artistic skill. Glass-making is, in a wide sense, a branch of pottery. This subject forms the theme of the next chapter.

CHAPTER XXXII.

DECORATIVE POTTERY, OR CERAMICS.

CERAMICS, or pottery, is among the oldest of the arts, and is perhaps the most widely diffused of all. Excepting in extreme polar regions, where its exercise is impracticable, it would not be easy to find a land where the potter's art has not been and is not now practised. It seems to have been indigenous everywhere, and everywhere to have been practised upon an extensive scale. The sites of ancient cities now uninhabited, on both continents, are often mere heaps of pottery, and sometimes, as in ancient Troy, layer after layer of broken earthenware, of different characteristics, show that city after city has one after another grown up and decayed upon the same site, with long intervals between them. The frail works of the potter have survived all other creations.

Clay is so easily fashioned into various forms, and when dried or baked so preserves those forms, that it was applied to many purposes for which other materials are now substituted. The oldest extant books were tablets of clay, into which the letters were stamped with a wedge-shaped tool, by means of which the so-called "cuneiform inscriptions" were formed. The potters soon began to exercise their invention in giving ornamental shapes to their wares. Caricature is perhaps the earliest development of art, and grotesque forms are more common than any other. Our museums contain specimens of early pottery, from the most widely-separated regions, ugly enough to please the most inveterate collector or antiquarian; and not unfrequently, as in Peruvian and Phœnician ware, these *bizarre* features are added to graceful forms. The adaptation of color is of very ancient date. The potter has it in his power to produce his effects by very simple means and with hardly any tools. Cameron, in the narrative of his journey "Across Africa," describes the operation of a female potter whom he saw at work near Lake Tanganyika, in the very heart of Africa:

"I was very much interested in watching a woman at her work. She first pounded with a pestle enough clay and water to make one pot, until she formed a perfectly homogeneous mass. Then, putting it upon a flat stone, she gave it a blow with her fist to form a hollow in the middle, and worked it roughly into shape with her hands, keeping them constantly wet. She then smoothed out the finger-marks with a corn-cob and polished the pot with pieces of gourd and wood, the gourd giving it the proper curves, finally ornamenting it with a sharp stick. I went to examine the work, wondering how it would be taken off the stone and the bottom shaped, and found that no bottom had yet been formed. But after waiting four or five hours in a shady place it was sufficiently hardened to be handled, and a bottom was then worked in. The pot held about three gallons. From beginning to pound the clay till one pot was put aside to dry occupied thirty-five minutes; and providing it with a bottom might take ten minutes more. The shapes were very graceful and truly well-formed, many of them being like the amphora in the Villa Diomed at Pompeii."

This primitive potter worked wholly by the eye and by the "rule of thumb," but she evidently had—most likely had inherited—what we have elsewhere styled an "educated hand." She apparently knew nothing of the potter's wheel, although that implement was used by Egyptian potters more than three thousand years ago. A few such pots, each costing the work of less than an hour, form almost the only household furniture of millions of African dwellings. From this rude pottery there is a wide step to the artistic ceramic productions now within the reach of all.

In our public museums and private collections there are few objects more attractive than ceramics. To those who have not the opportunity of visiting these, the recent works of Mr. Prime and Miss Young furnish a very satisfactory substitute. These books, with their profuse illustrations, not only afford a view of what had been done at the date of their publication, but give invaluable hints as to the means employed, and to be employed, by those whose capacities and inclinations may lead them to

TRENTON AND ITS POTTERIES.

DECORATING-ROOM OF TRENTON POTTERY.

See Note 29.

turn their attention to this department as a remunerative employment.

"Ten years ago," says Mr. Prime, "there were probably not ten collectors of pottery and porcelain in the United States. To-day [1877] there are perhaps ten thousand. The exhibition in public museums of the fine works of ceramic art revealed, for the first time, to the American public the wealth of beauty which is in 'old china,' and now, in nearly every town and village in the land, more or less persons are 'collecting.'" There are, indeed, "ceramio-maniacs," just as there are "biblio-maniacs," for whom the chief attraction of any work is that it is very old, very rare, or very odd, no matter if it is also very ugly and altogether useless; and when we read of hundreds of dollars being paid for an antique cup and saucer or teapot, simply because it is old and odd, we call to mind the old proverb touching the facility with which a fool and his money part company. Mr. Prime — himself a most enthusiastic, but withal a most sensible, collector of ceramics — has some weighty suggestions in this regard:

> "Antiquity adds nothing to the value of a specimen, unless it has some historical or artistic value apart from its age. Beautiful art, of whatever factory the product, is valuable. Beautiful art of rare old fabrics is more valuable because such specimens are sought for. But a beautiful work of an undistinguished factory is worth more than a poor work of a renowned factory."

But if the productions of the ceramic art had no wider use than to serve as harmless hobbies for mere collectors, they would have no place in such a volume as this, the object of which is purely practical.

> "Hitherto," says Mr. Prime, "America has been content to depend on Europe, China, and Japan for her supplies of beautiful pottery and porcelain. Within the last two years [1875–1877] an increased demand has been visible for the higher qualities of decorated porcelain. To meet this demand some of the New York merchants have employed foreign artists to decorate wares here, and admirable work has been produced. White porcelains are now imported and painted in New York, chiefly in the styles of foreign factories, no attempt at original patterns having been made. Occasionally are seen in the shops modern Sèvres porcelains which have been decorated in New York, and cups and saucers of Limoges ware, prettily ornamented. These are the works

of industrious men and women, and are to be noted as among the first efforts in America in decorative ceramic art. As such they deserve hearty encouragement."

They have received this encouragement, and have received it because they have more and more deserved it. We have begun to do something besides importing white pottery and decorating it after foreign designs. There are potteries, especially those at Greenpoint (near New York), at Jersey City, and at Cincinnati, where artistic and beautiful pottery is produced, and the designing of the wares and the decoration of them has grown up into a by no means inconsiderable branch of profitable occupation. Greenpoint plates, cups, saucers, and pitchers, and the Jersey City vases, show articles available for domestic use and ornamentation; while such more elaborate productions as the Greenport "Century Vase" and "Keramose Vase" aim successfully at a higher mark. What was hope and prophecy only eight years ago has since then become fact and fulfilment. The ceramic art, as applied to household decoration, has come to be an important and growing industry. We are no longer forced to fall back upon the productions of the "old masters" for materials, and it may be confidently anticipated that the growing wealth and culture of the American people will offer inducements still more ample than are now furnished for the profitable exercise of the artistic faculty.

But the one who seeks in this direction for a lucrative occupation must look wisely at his own capacities and must cultivate them to the utmost. He must acquire an education in industrial art. Fortunately the means for attaining this are coming more and more within the reach of all who wish to avail themselves of them. To begin with, it has come to be felt that drawing should form a part of the instruction in our common-schools, or at least in all which rank above the primary grades, for the money-value of art is coming to be appreciated. A person who cannot make a drawing is hampered from the outset in the most profitable parts of many industries. It is not to be expected that every person can become an artist in the highest acceptation of the term, but any one who can be taught to write a legible hand can be taught to execute an intelligible drawing. Then there are schools of decorative art and of industrial art. Among the many and great obligations conferred by Peter Cooper upon the community the art department of the Cooper Institute is among the foremost. In this and in several other art-schools instruction of the most practical nature is given. The carpenter, the cabinet-maker, the machinist will find it of immense advantage to be able to make a design upon paper. We have already indicated some departments in which this is quite indispensable, such as in paper-hangings, ceramics, etc.; the list might be extended almost indefinitely. Indeed, when we get beyond the bounds of the lowest branches of unskilled labor it would be hard to name any industry in which the ability to use the pencil will not often come into profitable exercise. Some of these special branches will be considered in the next chapter.

CHAPTER XXXIII.

THE INDUSTRIAL ARTS.

THESE branch out in every direction and touch upon every sort of handicraft. We note the present condition and future prospects of some of the leading industries. We have already spoken of the employments of the draughtsman and designer, in so far as they are directly related to architecture and household decoration, we now consider them more especially as applied to the illustration of books and periodicals, to the production of pictures to be reproduced and multiplied by the cunning hand of the engraver, so that instead of a single copy to be purchased by one person and seen by comparatively few there shall be many copies diffused among thousands and hundreds of thousands.

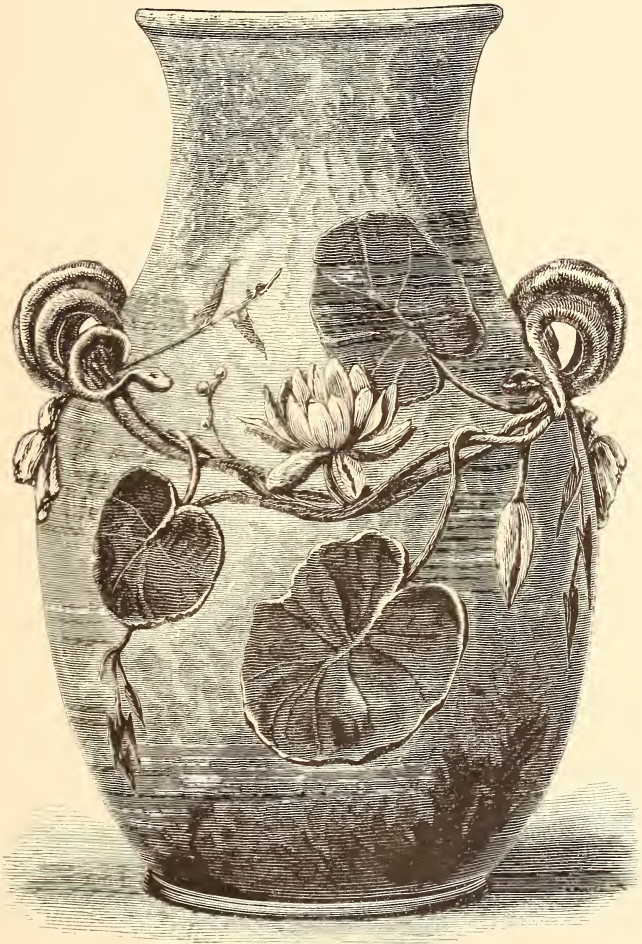
With pictures as with books it has been found that the public, except in a few cases, is a more munificent patron than any one class of it. Only a few persons can live by ministering to the necessities or inclinations of the few, whereas very many acquire competence or wealth by serving the many. All our modern tendencies are in the direction of the popularization of art as well as of everything else. Here and there a great painter has also occasionally acted directly as a designer for the engraver or other reproducer of works of art. Raphael drew cartoons for tapestry-workers; Albert Dürer and Hans Holbein drew upon the wood, and even sometimes engraved their own designs upon the block. But it is only within our own days that painters of acknowledged power have to any extent turned their attention to this special branch of their art: those who have done this have found it to pay. Competent designers having taken the field, competent engravers to interpret in black lines what they conceived in color have also sprung up, and the result has been that good pictures have become as plentiful as good books. The high artistic endowments requisite for a designer are but rarely bestowed, and the man or woman who possesses them need be at no loss in making this his avocation for life instead of considering it as merely a means of support while mainly occupied in producing other works.

The engraver, it has been said, occupies to the painter somewhat the position which the printer does to the author. But this is only a partial view of the case. The engraver is more especially a translator of the work of the designer. He tells in another language what the artist has told in his own, and he, moreover, enables the artist to address a far wider audience.

There are three methods of engraving, under one of which all are to be classed. These are not very happily designated as copperplate engraving, wood-engraving, and lithography. But metal plates have often been used for the execution of engravings in which the lines stand out in relief, while wood might be used for engravings in which the lines are cut into the surface of the plate.

LITHOGRAPHY is based upon the chemical law that oil and water will not mix, or, as it is sometimes expressed, "you cannot wet grease or grease water." The artist, with an oily pencil, or with a pen and an oily ink, makes a drawing, usually upon a slab of a particular kind of stone adapted to the purpose; the whole face of the stone is rubbed over with a wet sponge, but the water will not hold upon the oily lines of the drawing; then a roller covered with an oily ink is passed over the stone; the ink adheres to the pencilled lines which have been drawn, but will not touch the wetted parts of the stone. A sheet of paper is laid upon the drawing, which is passed under a heavy roller, and the ink is thus transferred from the drawing to the paper, and so on for each separate impression. This process of printing is a slow one, and consequently is comparatively costly, and is wholly inadequate where a large number of copies are required in a short time. Its merit is that the picture is precisely what the artist made it, whether good or bad, whereas in an engraving properly so called the result depends no little upon the skill of the engraver. It is no more difficult to make the drawing upon the stone than with a crayon upon paper, and from this one drawing a large number of copies can be printed. Lithography is especially adapted for large portraits and also for the reproduction of architectural and mechanical drawings, where no great delicacy of line is required. For the wider purposes of illustration of books lithography is almost wholly superseded by wood-engraving.

Copperplate Engraving.—In this method of engraving the lines and dots which make up the picture are cut, one by one, into the surface of a polished plate of metal. If this engraved plate could be printed from in the same manner as with ordinary types the cut would consist of white strokes upon a black ground, like the marks of a white pencil upon a black slate. The whole effect of the cut would be reversed: the portions which should be light would be dark, those which should be dark would be light. In printing from a copperplate engraving the whole surface of the plate is covered over with the ink, which also fills up all the engraved lines; the ink is then carefully wiped from the surface of the plate, leaving only that which fills the incised lines. The sheet of paper is then laid upon the plate, which is passed under a heavy roller, which presses the surface of the sheet into the lines, and the ink in them is taken up. This inking, wiping, and impressing must be repeated for each copy, so that the process is even slower than that of lithographic printing. Five hundred copies of a print of the size of a page of this volume would be as many as two men working together could throw off in a day. Etching differs from copperplate engraving only in this: the plate is covered with a thin coating of varnish, through which the lines are drawn upon the metal and then "bitten" into the plate by a strong acid instead of being cut in with the graver. Very often the two modes are combined in the same plate, the heavier parts being bitten in by the acid, the more delicate ones cut by the graver.



FAIENCE VASE.

See Note 29.

The rubbing to which the plate is subjected wears it away so rapidly that not more than a few thousands of good impressions can be taken from a copperplate. This objection is partly obviated by making the engraving upon a plate of soft steel, which is afterwards hardened. Engraving upon steel differs in no respect from engraving upon copper, its sole advantage being in the greater number of copies which can be printed from the plate.

Copperplate engraving is capable of producing finer effects than any other method. The engraver has his choice of every kind of line or point — he can make his lines as heavy as he chooses or finer than a hair; he can cross and recross his lines at will, just as though he were using a pencil. The main objection is the slowness of the printing and the consequent cost, which render the whole process unavailable to meet the requisites of ordinary book and periodical illustration. Still there are many uses for which there is no substitute. Foremost among these is the reproduction of paintings of the highest class. A copperplate engraver of the highest merit undoubtedly stands at the head of his profession, and of course earns in proportion.

Wood-Engraving.—The process of engraving upon wood is the exact reverse of that of engraving upon copper. In it the lines which form the picture are raised instead of being sunk; or, rather, all except the lines is cut away, leaving them standing in relief. One can gain an idea of the comparative difficulty of the two methods by closely examining a copperplate and a wood engraving. In the former the engraver has cut each black line into the plate as we see it, and as his graver has a triangular point, the deeper he cuts the thicker will be the line, and he can thicken the line from time to time, as he sees fit, in order to produce such depth of color as he finds best for the general effect. But, in the latter, the engraver has cut out one by one each separate white line or point as it appears in the print, leaving the black lines standing. If he should cut away too much there is no remedy; unlike the copperplate engraver, he has no means of deepening the color if he has once made it too light.

He can put in more light if he chooses, but cannot put in more shade.

Let one try to reproduce with pencil and paper the lines of a simple part of a wood-engraving. With a fine black pencil, upon white paper, he will find little difficulty; the hardest thing, perhaps, would be to reproduce it exactly. If he make an exact copy he will have done just what the copperplate engraver would have done. Then let him, with a fine white pencil, attempt to make a similar copy upon black paper. If he succeed in making this he will have done just what the engraver has done, for this is a woodcut, after all. The engraver has accomplished a difficult task, and has succeeded in doing tolerably well only what a copperplate engraver of equal ability would have done better and with less labor.

Engravings in relief have not unfrequently been executed upon soft metals. Wood has, however, been found the best material for the purpose. Boxwood is the only kind which has a grain sufficiently close for fine cuts, and this is sawed across the grain, and not in boards or slabs. The art has been practised in China from time immemorial, for a page of a Chinese book is a woodcut, with the letters in relief. The oldest known European woodcut bears the date 1423.

Wood-engraving in the United States dates back only to about 1830, and some tolerable work was executed within the succeeding ten years; but for nearly twenty years more the American engravers were far behind their European contemporaries. Nearly all the good engravers were foreigners who had learned the art abroad. To-day, American wood-engraving is, beyond question, the best in the world, and perhaps the best idea of its progress may be gained by examining the successive volumes of *Harper's Magazine* since 1855, when original illustrations began to be a prominent feature of its management, and the very best which could be executed at the time were secured, although for several years after the bulk of them were mere reproductions of the work of foreign designers and engravers.

But we have to do with the economical rather than with the historical or artistic aspects of the subject. The great advance of the last fifteen years has been partly the effect and partly the cause of the increased artistic appreciation of the American public, and there has been a wholesome rivalry among those publishers who have taken it in hand to meet the growing want. They have been wise enough to see that it was not enough to keep abreast with the public; they must move in advance of it, and offer better productions than their patrons were then prepared to appreciate.

This better work could only be had by offering pecuniary inducements sufficient to stimulate greater endeavor on the part of a higher order of artistic talent, both among designers and engravers. The times are past—if they ever existed—when artists were content to work without liberal payment, and now that they have the great public for their real patrons there is no need that they should do so. The cost of producing a handsomely-illustrated work is hardly suspected by the person who purchases a copy. The amount paid to the draughtsmen and engravers of each of the cuts which have been presented in this volume as types of our best wood-engraving is not less than three hundred dollars. From this an approximate estimate may be made of the entire expenditure for this one purpose of illustration. This sum, if divided among the copies of an edition of a few thousand, would amount, for each copy, to more than the price of the volume. But when this total amount is spread over scores or, perhaps, hundreds of thousands of copies, it becomes comparatively small for each.

It need not be repeated that the avocation of the wood-engraver is now among the most remunerative. That it will continue to be so is as certain as anything can well be, so long as the country keeps on advancing in wealth and culture. The causes are permanent and the effect cannot be transient. To us it seems hardly possible that engravings better, as such, than the best of those now made, can be produced in the future. We may hope to have better pictures, for there is no limit which we can assign to the development of that genius which is required to create a picture. But it seems to us that the engravers whose names are attached to the cuts here given

—and many more who rank fairly by their side—have done nearly all that can be accomplished in black and white lines to reproduce the thought and intent of the designer.

To a certain extent wood-engraving is a mechanical art, depending upon accuracy of eye and dexterity of hand. This was notably so until quite recently, for the designer was accustomed to draw with his pencil every line just as he wished it to appear in the cut; but, working in black while the engraver worked in white, he often used lines easy for him to produce with the pencil but hard for the engraver to preserve by cutting around them. As engravers became more and more artists and less mechanics, it was found that the arrangement and form of the lines might better be left mainly to them, and the designers merely drew the dominant lines which gave the form and washed in the other parts with India-ink, so as to produce the color and effect, which the engraver reproduced in line. The result is shown by the illustrations in this volume, which comprise some of the finest specimens of the art of wood-engraving. No finer ones can be found in any book expressly devoted to art.

The wood-engraver who shall attain high success should be aware of the conditions essential to that end. He must possess genuine artistic feeling to begin with. He may not be able to produce the design which he is to render, but he must perceive just what was the idea or feeling which the artist meant to embody, and be able to render it by the methods of his own art. The great composer is not of necessity a great singer: he may not have a voice capable of expressing the music in his soul. The translator of a poem from one language into another may not have been able to have written the poem in either language, but he must well understand the language *from* which he translates, and must have a full mastery of that *into* which he translates. Form and tint and line are to the artist what words are to the author. The engraver reproduces the forms of the artist and translates his tint into his own lines. Upon the ability with which he does this depends his success in his profession.

A thorough education of the eye and hand are indispensable, and they must be trained to work together. The hand of the engraver works under the constant direction of the eye. No tremulous or inflexible hand can belong to a good engraver. It might be supposed that the superior delicacy of the female organization would render engraving peculiarly a fitting employment for women. It certainly has some special adaptations. It does not involve great physical exertion, and it can be practised at home as well as elsewhere. The experiment has been begun—as in the school for engraving in the Cooper Institute—but it is yet too early to pronounce positively upon the degree of its success. This much may be said in its favor: Women here stand upon an equal footing with men. The female writer is paid as highly as the male writer, provided that her work is as good, and the woman who engraves will command as high remuneration as the man of like ability and skill. Art and literature know no sex. The quality of the work accomplished, not the personality of the doer of it, governs the remuneration and the fame.

The application of the artistic faculty to practical industrial purposes, so that it shall open new and wide avenues for success, ranks high among the subjects of general interest. The industrial arts must come more into exercise as the requirements of the community extend beyond the bare necessities and conveniences of life.

CHAPTER XXXIV.

OPPORTUNITIES IN THE SCIENCES AND ARTS.

IT is not easy to draw any exact line between the Sciences and the Arts. The two departments of thought and endeavor overlap each other upon every side. There is one thing which they have in common in our age. The persistent tendency of our times is to direct all research, speculation, and endeavor to some practical result. Knowledge is regarded not so much as an ultimate end, to be sought for its own sake, as it is for a means for the attainment of some further end and object, that object being the augmentation of the sum of human comfort. Money is but a form for the expression of the amount and degree of this augmentation. The money-value of a thing is precisely the amount, expressed in pounds and shillings, or dollars and cents, of the comfort or pleasure which it may be made to afford its possessor. Some have styled ours a "money-getting age," by way of censure and sneer, and have poured forth torrents of lamentation and objurgation over the prevailing "haste to get rich." With all this we have no sympathy. We hold that the man who in any way produces anything which adds to human comfort and happiness is the useful and estimable man. He who does not do this is the useless man —useless to himself and to others. The useful man is the one, and the only one, who ought to be successful in any sphere of life.

But the man who puts in thought and knowledge, science and enterprise, contributes more than the one who puts in merely muscular labor, and deserves a higher reward. The ox that drags the plough is not the real plougher of the field; it is the man who devised the plough, and that other one who guides the team. The operative who works at the loom is not the chief manufacturer; it is the man who invented the loom, and he who builds the mill, provides the machinery, and directs the whole series of operations. If his contribution consists of capital rather than of immediate labor or thought, still, that capital is the product of previous labor performed either by himself or by some one from whom he has received it. There are few men who have not far more of capital in the form of thought and skill than they ever put to use. If they bury this capital through disuse, they cannot reasonably expect to make it pay interest or yield a profit. In all that has gone before, one aim has been to point out some of the directions in which this kind of capital may be utilized to the advantage of its owner, and in all that is to follow this will be held strictly in view.

Physical Science is the study of the laws of physical nature. By "Applied Science" we mean the direct application of these laws to the increase of human comfort and physical well-being. It is industry guided by knowledge. With all the progress in this direction of which we boast, we have taken only the first steps in any of the paths. We shall indicate some of these applied sciences which at the present time seem to promise large rewards to those who shall wisely cultivate them. What has been successfully begun is one of the safest guides as to what may still be accomplished.

Chemistry.—It was long before any practical effort was made to apply this science to any really useful end. Bewildered by baseless theories, the alchemists wasted their lives in the vain attempt to discover the "philosopher's stone," which should transmute the base metals into the precious ones; or the "elixir of life," which would confer immortality upon mortals. But no sooner did students abandon these dreams, and begin to direct their researches and experiments to practical ends, than ample results rewarded their efforts. There is no hour in the day in which every one of us does not receive much benefit from the work done for us by chemists. These are so common that we are wont to forget how few of them were attainable even by our immediate forefathers. The means by which we illuminate our dwellings and streets, thus doubling, if need be, the hours for labor or recreation, are among the results of applied chemistry. Most of the medicines which alleviate our sufferings or cure our diseases are the direct products of applied chemistry. We write with chemical ink, and color our fabrics with chemical dyes. Applied chemistry enters largely into the production of the bread which we eat. The steel which edges our knives, even iron, as we use it, is a chemical product. The gunpowder which tears down mountains to make way for our highways, and fights our battles for us, is the product of the chemist's laboratory. Let the traveller find himself in a region where matches are not to be had, and attempt without them to light his fire by rubbing two sticks together, and he will begin to apprehend what are some of the debts which he owes to the chemist. Hardly a day passes that does not add to the sum of benefits conferred upon us by applied chemistry. The field still unoccupied or only partially explored is yet so vast that there is no danger of its becoming overcrowded. The practical chemist must find lucrative occupation, and should he make—as many will make—any valuable addition to the supplying of the public wants, his reward will be ample.

Civil Engineering. — Instead of solving old mathematical problems or propounding new ones, men of the highest genius now turn their attention in a practical direction. In place of inventing "magic squares," or endeavoring to "square the circle," they set themselves to work in studying the strength of materials, the best forms of the arch, the proper slope of embankments, and the like. They level the lines of railroads, devise means of directing the course of rivers, and build bridges such as no former age would have dared to imagine. They construct works for irrigation which will fertilize regions which would otherwise be deserts; and devise and execute systems of drainage which will avert pestilence from crowded cities.

There is no assignable limit to the field which lies open to the competent civil engineer; and it is a hopeful sign that this is becoming more and more appreciated by aspiring young men.

A generation ago, to say that a youth was "getting an education" was equivalent to saying that after he had acquired a little Latin and less Greek, a little algebra and the rudiments of geometry, he proposed to become a clergyman, or a lawyer, or a doctor. The student who now expects to make his way in the world turns aside from the old classical curriculum, and either takes a "special course" in the university or enters a school of technology, devoted to instruction in some or all of the physical sciences. The man who undertakes to master the science of civil engineering will soon find that he has enough to do to occupy all the time and thought which he can devote to the study of that one science. But he has undertaken to fit himself for doing work which the public demands, and for which it stands ready to pay.

Electricity.—Some five centuries before the beginning of the Christian era Thales of Miletus, a kind of Greek Benjamin Franklin, happened to be rubbing a piece of *electron*, or amber, and carelessly touched it to a feather or some other light substance, which he found to be attracted by it. To this hitherto unobserved natural force he gave the name of "electricity." He little dreamed that this apparently feeble force was in time to become one of the most efficient—not improbably *the* most efficient—servant of man. Not quite a century ago Galvani of Bologna, in like manner by accident, brought the leg of a dead frog in contact with two dissimilar metals; a convulsive action ensued, and the force which produced this was found to be identical with, or at least kindred to, that which attracts the paper-shreds to the rubbed amber or glass, and that which keeps the ends of the magnetic needle pointing towards the northern and southern poles. Franklin had shown that this feeble force was identical with that manifested in the lightning; but no one for long years dreamed that this could be made serviceable to man. Up to the beginning of the present generation electricity in any of its forms was nothing more than a scientific plaything, which might perhaps be turned to some slight practical purpose.

We all know what service this humanly developed electricity has been made to render. In the telegraph it sends our messages around the globe with a rapidity like that of light. The telegraph alone renders possible those simultaneous comparisons of meteorological observations which may result in a science of weather-prophecy. A suspension of telegraphic communication would bring about a revulsion in the commercial business of the world. In the telephone, electricity does for sound what the telescope does for the vision. In electrotyping it plates the precious metals upon the cheaper ones, and makes a perfect *fac-simile* of the most exquisitely engraved plate or block.

But the possible powers of this newly yoked servant of man have only begun to be called forth. There seems to be no reason to doubt that the time is close at hand when the electric light will to a great degree supersede gas as a means of illumination; when we shall work and study by the flashes of lightning made permanent instead of momentary. There is, moreover, good reason to anticipate that electricity will, at no very remote period, largely take the place of steam as a motive-power; although it is not many years since one of our foremost authorities in science laid it down as a matter "long since settled that the motive-power derived from electro-magnetic combinations can only be secured at an expense which forbids its employment on a large scale;" the most that could be said was that "for many purposes, in which the consideration of cost is unimportant, the convenience of application of this power has secured for it an acceptance which is becoming every year more general." But the great Dionysius Lardner a few years ago demonstrated most mathematically that steam could never be successfully employed in ocean navigation, because no vessel could carry coal enough for a voyage of three thousand miles. Men whose opinions are entitled to great consideration now look forward to a day not far distant, when many of our railroads will be operated by electricity. In any case, there can be no question that the industries in which this force is and is to be employed must furnish profitable occupation for many more persons than are now engaged in them.

Mineralogy.—In the chapter on Mines and Mining, statistics have been given which show that, next to agriculture, mining is the most important of the world's industries; indeed, without this few other industries could be successfully practised. The United States include what are pre-eminently the mineral regions of the globe. With the exception of tin, there is no valuable mineral which is not abundant in large sections. Fully two thirds of all the coal known to exist is here. The production of iron in any country must in time depend to a great extent upon that of coal; and there is to-day more probability that the continent of Europe will have to look to us for coal and iron than there was twenty years ago that Europe would look to America for bread and corn.

The increase in the demand for food must, of course, keep nearly equal pace with the increase of population, and be limited by it; but the uses of metals multiply much more rapidly than the population does. We have the metals so readily at hand that it cannot be very long—protection or no protection—before we shall cease to import them; for we shall be able to produce them more cheaply than we can buy them abroad. In another chapter we speak of the possible—nay, probable—future importance of what may be styled the chemical metals, aluminum and magnesium.

We use the word mineralogist in its widest signification, to designate all those, except mere diggers of the ores and other unskilled laborers, who are occupied in the production of minerals, and rendering them into the forms in which they are used by the artificer. It will thus include a wide range of vocations, from the mining engineer who plans the drifts and tunnels, to the expert who analyzes the ores, and the assayer who frees the metal from its alloys and impurities, or combines the ores so as to produce that form of the metal in which it is best adapted for the special end in view.

The range of knowledge required by the practical mineralogist is wide, and requires apparatus and appliances upon a scale which can be furnished only by large institutions. Until within a few years, American students have been obliged to go abroad and study in such German schools as Berlin, Freiberg, or Clausthal, at Schemnitz, in Hungary, or Leoben, in Styria; at the

Ecole des Mines in Paris, or the Royal School of Mines in London. Undoubtedly, something may be learned in each of these great schools better than anywhere else. But we are well assured that no one of them presents greater opportunities than are furnished at the School of Mines of Columbia College, the Sheffield Scientific School of Yale, the School of Mining and Practical Geology of Harvard, the Scientific Department of the University of Pennsylvania, the Rensselaer Polytechnic Institute of Troy, the Massachusetts Institute of Technology at Boston, or the Stevens Institute of Technology at Hoboken. With such ample means for acquiring instruction, and such widening fields for the exercise of the knowledge acquired, the vocation of practical mineralogy is one which must be more lucrative than most others.

GLASS-MAKING. — Glass is an artificial compound, produced by melting together silex and potash or soda, to which lime, borax, and lead are sometimes added, for various purposes, the result of the fusion being a more or less transparent, brittle, insoluble substance of extreme hardness, and acted upon by no acid except hydrochloric. The manufacture of glass is of great antiquity, but it was mainly used for decorative and ornamental purposes; its use for windows not being at all common until the revival of civilization after the overthrow of the Roman Empire. The manufacture of glass is an important industry in the United States, the growth of which has more than kept pace with the increase of population.

As reported in the Census of 1870, there were in the United States 201 glass-works, employing 15,822 hands, the value of the product being (in gold) $15,235,862. In 1880 there were 211 glass-works, employing 24,177 hands, the value of the product being $21,154,571; an increase of 52 per cent. in the number of hands employed, and of 38 per cent. in the value of the products; but the average wages paid was about the same, $380 per hand, of whom about one fourth were women and children. There were in 1880 glass-works in fifteen states of the Union; but about three fourths of them were in Pennsylvania, New Jersey, New York, and Ohio.

A large part of the work in the manufacture of glass is performed by unskilled labor, and is paid for as such. But in the production of ornamental and decorative glass-ware, and especially in painting upon it for windows, there is a growing demand for artistic work of a high though special character.

"Glass-painting," says Mr. Charles A. Cole,* "is an art taxing the highest pictorial resources. The artist should be a student of history, sacred and profane, well versed in ecclesiastical and civil costume, armor, heraldry, conventionalism, symmetry, coloring, and the manufacture of colors. It is necessary that he should draw geometrically, mechanically, and artistically, and strengthen himself with a mechanical knowledge of combining numberless parts to compose a whole, the effect of which he has scarcely an opportunity of forming any other than a problematical judgment until the entire work is erected, and which, therefore, he can acquire only by habit and intuitive feeling."

Until quite recently painted-glass windows were confined wholly to Catholic and Episcopal churches, and they were almost always the work of foreign artists. But now windows of painted glass are coming to be more and more common in churches of other denominations and in private mansions. The painter on glass must ever keep in mind the restrictions imposed upon him by the very nature of his work. Unlike oil-painting, it excludes minute detail, partly on account of the greater distance at which the picture is to be viewed, and partly because this detail, which is capable of great effect on an opaque surface, would be lost through the transparency of the glass. A painting on glass is incapable of those nice gradations of color and of light and shade which are indispensable for direct and close imitations of nature, and for producing the full effect of atmosphere and distance. And, moreover, if this difficulty could be surmounted, the bars, or other window work, would spoil the effect of such a picture. A landscape should not be the principal feature of a painting on glass; neither should a figure or group of figures which require much foreshortening. The figures should occupy the immediate foreground, not running into the distance. This subject is worthy the consideration of the public as well as of

* *Harper's Magazine*, October, 1879.

artists, and we therefore quote a few further sentences from Mr. Cole's suggestive paper:

"In the glass-painters' workshops in New York—we write these remarks in one of the most noted—may be seen devices, at a cost within the reach of the majority, which would brighten and illuminate habitations large and small. Here are windows filled with medallions, or panels, containing colored pictures arranged in a symmetrical manner, and imbedded in a mosaic ornamental ground formed of rich colors. Here are pictures without number representing successive incidents in a parable, a story, or legend, or poem. Profuse in fancy are groups of leaves—the maple, oak, ivy, and the parasitical plants—as well as birds and insects; the scroll-work being formed of the twining tendrils of plants or of boughs or branches. Borders, with stalks running up the sides of the panes, either in a serpentine manner or straight, from which spring leaves, acorns, nuts, fruit; the stalks perhaps of one color, the leaves of another, all introduced on a colored ground. Attractive enough will be found the common 'decorated patterns,' consisting of a number of narrow fillets and bands, some colored, some ornamented, but for the most part plain and white, disposed in the forms of circles, lozenges, ovals, quatrefoils, and other geometrical figures, or even simply reticulated, and curiously interwoven with each other. Meanwhile, some advice may be remembered with profit by any one who wishes to use painted glass as a household ornamentation. The positive colors ought to be employed sparingly, and confined to the chief points of the composition. When overloaded with color, the sparkling brilliancy so desirable in painted glass is entirely lost. The general ground of the window, for example, should be of a neutral tint, suitable in tone to its character and situation."

The demand for painted glass has produced among us artists capable of meeting all desires. Forty-five years ago there was not a single manufactory of this kind in the United States. Now, within the compass of a few streets, near Broadway and the Fifth Avenue, in New York, one may count the studios of a score of painters upon glass, and there is no considerable city in the Union which does not possess artists of this class—attractive to those who practise it from the remuneration which it affords, and to the public from the beauty of their work. Facts fully justify the statement of Mr. Cole that "glass-painting of a high order of art is accessible in this country, and there is a large and increasing demand for it as a means of household decoration"—a demand which shows a constant increase.

Closely allied to painting upon glass is the production of ornamented glass-ware. There is, indeed, no other substance,

ON A MARKET-BOAT IN NORTH HOLLAND.

See Note 30.

except clay, which so readily lends itself to many useful and ornamental purposes as glass. Composed of the very cheapest and most common of materials, human skill fashions it into forms which serve to gratify not only the humblest needs, but the most refined tastes. Ornamental glass-ware has long been a special industry of Venice. This graceful and useful art is making its way among us, as, indeed, it should; for there is no reason why the most common articles of glass-ware should not have the beautiful forms which the natural beauty of the material suggests. Up to a certain point beauty costs no more than ugliness; and beyond this there is no conceivable limit to the artistic labor which may be lavished upon the shaping and ornamenting of glass-ware.

Working in the Precious Metals.—In the arts of pottery and glass-working the artist and workman give value to materials which are in themselves almost worthless. The worker in gold, silver, and precious stones confers additional value upon the most costly materials. The production of silver-ware, and of ware plated with silver, has grown to be a very important industry in this country. There are establishments in which it is conducted upon a very extensive scale; and the advancing culture of society demands a higher and still higher grade of artistic merit, and the cultured public is ready to pay liberally for the gratification of its tastes.

The manufacture of silver-ware in the United States dates from 1831, when Jabez Gorham began to make silver spoons at Providence, Rhode Island. In about thirty-five years the "Gorham Manufactory" became the largest of its kind in the world; and there are now several others of scarcely less extent. Each of these establishments carries on a dozen or more distinct trades. To make spoons and forks is a trade of itself; to make cups, vases, and other large vessels is quite another. Chasing is one trade, embossing another. Die-cutting, pattern-making, moulding, engraving, burnishing, polishing, are all separate trades, each of which requires a regular apprenticeship in order to become a competent workman. It is the business of all of these trades to carry into effect the conceptions of the designer, whose aim is not merely to produce beautiful forms, but also to unite elegance with convenience; always to be ahead of public taste, so as to be ready to furnish to the purchaser something superior to that of which he is in search.

The business of the jeweller, as distinguished from that of the silver-worker, also presents numerous openings for the highest order of workmanship. The census of 1870 reports 18,508 "Gold and Silver Workers;" in 1880 there were 28,405, an increase of 53 per cent. The labor is almost entirely "skilled," and receives a corresponding remuneration. The average wages for "jewellers" of both sexes and all ages, including apprentices, is given in the census at $640 per year. The large percentage of increase in the number of persons employed evinces the increasing demand for their services.

CHAPTER XXXV.

PATENTS, PATENT-RIGHTS, AND PATENTEES.

A "PATENT," in the widest sense, is defined to be "a grant made by the government or the sovereign of a country to some person or persons of some privilege, property, or authority; or the exclusive right to some new invention, discovery, or improvement." Under the first clause of the definition are included the numerous monopolies arbitrarily bestowed by sovereigns upon their favorites, and these still exist in various European countries. In England this was limited by an Act of Parliament in 1624, which prohibited the granting of exclusive privileges in trade, with the exception that letters-patent might be issued for a term not exceeding twenty-one years, "for the sole working or making of any new manufacture within this realm, to the first and true inventor of such manufactures." The earliest English letters-patent, in our sense of the term, were issued in 1643, to Arnold Rotsipen, for an improvement in printing machinery. The earliest American patent was granted in 1641, by the General Court of Massachusetts, to Samuel Winslow, for a process of making salt; and in 1653 a royalty of ten shillings was granted to John Clark, to be collected from every family which should use a method devised by him for "saving wood and warming houses at little cost."

Grave objections have been urged against the patent system, all of which resolve themselves into this, that they create monopolies which deprive other persons than the patentees of the exercise of certain rights belonging to them. "Suppose," it is said, "that a certain man has, whether by study or accident, discovered that by mixing India-rubber and sulphur together in certain proportions and submitting them to a certain degree of heat a new and valuable substance is produced, what right does that give him to prevent any other person from doing the same thing with his own materials and producing the same result? All persons had originally the same right, and the fact that he was the first to exercise it cannot invalidate the right of any one else. If he has discovered such a process he may, if he choose, keep it a secret, or divulge it to whom he pleases and upon such conditions as he pleases, and make as much of it as he can in that way, and that is the limit of his right in his discovery; all beyond this is an arbitrary monopoly, and monopolies are, by their very nature, against the public interest."

To this it is replied: "It is for the public interest that men should be encouraged and stimulated to study and experiment for the purpose of making discoveries and inventions; and if these are of public advantage the public should, for their own good as well as in justice to him, in some way remunerate the inventor for the benefit which he has conferred upon them. They may do it by bestowing upon him a specific sum, as when Jenner was awarded £10,000 for his discovery of the process of vaccination, Davy £2000 for the miner's safety-lamp, or Whitney $50,000 for the cotton-gin; but in the great majority of instances this mode would be ineffectual, for governments are rarely in a position to ascertain accurately the benefits which may accrue to the public from any particular invention. It is far better to frame general laws to effect the object, and there are no apparent means of doing this so surely as by bestowing upon the inventor the exclusive right, for a certain time and upon proper conditions, to the profitable use of his invention. Let him put up this right for sale in what way he pleases, and the public will pay him as much as it is worth to them and no more. If it is worth nothing to them the inventor will receive nothing, no matter how much time and labor it may have cost him; if it be worth much he will receive much, no matter how little labor it may have cost him. The question is not how much it has cost the inventor, but how much the public find it worth to them. In granting such a patent, it is further said, the

Government, representing the people, does indeed surrender to the patentee certain of their rights, but it does so for a valuable consideration. The patentee also surrenders certain rights belonging to him. He imparts to the public certain information, valuable to them, which he was at perfect liberty to withhold. The whole transaction is in effect a bargain between the State and the patentee. The State, by its patent-law, makes certain propositions open to the acceptance of all whom it may concern; the inventor, by applying for a patent, accepts those propositions, and both parties are rightly held to the fulfilment of the conditions of the bargain."

Nearly all civilized States have come to the conclusion that the manifest advantages of a system of patent-laws far overbalance any alleged disadvantages. In Holland, Greece, and Switzerland, however, no patents are granted, and in some of the States of the German Empire they are looked upon with disfavor. In Prussia the annual average number of applications for patents is about 800, of which only about one-fourth are granted, and the patentee forfeits his exclusive right if he suffers his invention to be unemployed for twelve consecutive months; and, moreover, the patent gives him only the exclusive right of manufacturing the article within the kingdom, and does not hinder the sale there of similar articles produced abroad.

In most European countries patents are issued for various periods up to a certain number of years. In Great Britain a patent may be taken out for three years, the fee being £25; it may be renewed for four years more for £50, and for an additional period of seven years for £100 more; so that the entire cost of a British patent for fourteen years was, until recently, £175, or about $875. Some modifications have, however, been recently introduced. In France a patent may be taken out for five, ten, or fifteen years, and is subject for each period to an annual tax of 100 francs, so that the total cost for a patent for fifteen years is 1500 francs, or about $300. In Austria a patent may also be taken out for fifteen years or for a shorter period, the tax for each period of five years being double that of the preceding five: thus, for the first five years it is $48.72; for the second five, $97.44; for the third five, $194.88, amounting in all, for fifteen years, to $341.04. In Russia a patent may be taken out for three, five, or ten years, the entire cost for one of ten years being $357. In the United States a patent runs for seventeen years, the entire cost of obtaining it being only $35. It is owing in a great measure to the comparatively small cost that probably as many patents are taken out in the United States as in all Europe.

American Patents.—The United States Patent-office is one of the bureaus of the Department of the Interior, all the officials being paid by fixed salaries from the Government. But an applicant for a patent must pay a fee of $15 upon filing his application, and an additional $20 when the patent is issued. The term of the patent is now fixed at seventeen years. Since 1875 the term of a patent can be extended only by an Act of Congress. Copyrights for books, maps, engravings, and artistic designs, though essentially of the nature of patents, do not come within the jurisdiction of the Patent-office.

Obtaining a Patent.—The general principles regulating this procedure are easily understood. Any person, whether a citizen or alien, may obtain a patent for any "art, machine, manufacture, or composition of matter, or any new and useful improvement thereof," of which he is the inventor or discoverer. The thing patented must be both "useful" and "new." As to usefulness, the law is very liberally construed. It does not prescribe any absolute degree of utility. An invention which is injurious to health or public morals, or which is designed to facilitate the perpetration of crime, is not patentable, because of what is denominated its "want of utility." The most novel and ingenious burglars' "jimmy" or thieves' picklock would not be patentable; but we suppose that if the philosopher of Laputa had succeeded in extracting sunbeams from cucumbers, he would have found no difficulty in obtaining a patent for his discovery in the United States.

Novelty of an Invention.—In respect to this there is need of much care on the part of the inventor. To be "new," in the legal sense of the term, the invention must not have been known or in use by others in this country, and must not have been patented or described in any printed publication in this or any foreign country; and the inventor himself must not have allowed the use or sale of his invention for more than two years previous to his application for a patent. If he has done this, it is held that he has thereby abandoned his invention to the public use.

Completeness of the Invention.—An invention to be patentable must be so far completed that it shall be capable of being put to use without further addition, and so that the means of producing the result aimed at may be accurately and fully set forth. The mere conception that a certain end *may* be secured by certain means is not sufficient. Mere experiments are not patentable; but, supposing that the invention consists of a process or a composition of matter, the inventor is not required to be able to explain *why* the effect is produced. It is sufficient that he has discovered what materials are necessary, and how they may be applied, to produce the required effect. Goodyear could not tell—and perhaps no one else can tell—why exposing a compound of India-rubber and sulphur to a strong heat produces a new and valuable substance. It was sufficient that he ascertained the fact, and discovered the means which produced the result. Nor is it necessary that the invention shall be the outcome of long labor or study. It may be the result of sheer accident, as was the case in the vulcanizing of India-rubber.

What may be Patented.—The discovery of a principle that is a law of nature is not patentable. Thus, no one can acquire an exclusive right in the properties of the electric fluid, nor in that actinic power of the sun's rays by which photographs are produced; but the discoverer of any new mode of applying the electric power may secure the exclusive use of his own mode. In brief: the discovery of a principle, a natural law, a scientific truth, or any property of matter, is not of itself the subject of a patent; but any one who makes a new and useful application of any of these, or invents new machinery or any new processes by which desirable results can be attained, may secure a patent, not for all possible applications of the abstract principle, but for his methods of practically applying it. The application of an old invention to new uses is not patentable. There was a well-known machine for curling hair for mattresses; some one applied for a patent for the use of a similar machine for curling palm-leaf for the same purpose; this was refused. The application of ether as an anæsthetic was held not to be patentable, because "the claim was for a new effect produced upon old subjects, by old agents, and operating by old means."

Nature of the Right to a Patent.—From the nature of the case the privilege secured by a patent can only be secured by positive law. Apart from such law there is nothing to prevent any one from repeating, for his own advantage, what has been done by any other person. A man may have discovered some means by which two blades of grass may be grown instead of one, and he would be a great public benefactor; but, in the absence of positive law prohibiting it, any other man may rightfully adopt all his methods. The patent laws endeavor to provide for such cases by conferring upon the discoverer a temporary exclusive right to its use. For how long a period this right shall exist must be somewhat arbitrarily determined. It is generally conceded, on the one hand, that it should not be perpetual, and, on the other hand, that it should be for so long a time that the inventor shall be repaid; and, after that, this right shall revert to the public, by whom it was temporarily granted. The grant of a patent-right to the inventor, and his acceptance of it, is in effect a contract between the State and the inventor, in which the former gives to the latter, upon certain conditions, the exclusive right to the usufruct of his invention in consideration of the benefit which the public may receive from it during that time and thereafter. The issue of a patent is not, however, an absolute guarantee of the right which it purports to secure; it is merely *primâ facie* evidence of such a right, giving to the patentee a power of action for any alleged infringement.

Forfeiture of the Right to a Patent.—The right to take out a patent may be forfeited in several ways: if the inventor fails to apply for a patent within two years after the invention has been put upon sale or has been in public use, he is held to have abandoned it to the public, and such abandonment is a forfeiture of the exclusive right. To this rule there is an apparent exception. After having conceived the general idea of an invention which he wishes further time to perfect, the inventor can enter a *caveat* in the Patent-office, setting forth the characteristics of his invention and asking protection for his right in it until it shall have been perfected. This caveat is kept secret in the Patent-office; but in case during a year any other person puts in a claim which apparently interferes with his, he is entitled to notice of the fact from the Commissioner of Patents, so that he can appear and prove his own priority. A caveat may be renewed from year to year, the fee for filing it being $10, and $30 for each application for a re-issue of it.

Moreover, an inventor may so deal with his invention as to create an abandonment of it at any time. This may be done if the invention is, with his knowledge, generally used by others. Delay in applying for a patent does not of itself constitute an abandonment; but an unreasonable delay, and especially if another person has originated the same invention, will involve the risk of losing his right to it. Whoever restores a lost or abandoned invention may obtain a patent for it, just as though he were the original inventor. The patentee of anything patentable is in law the inventor of it. Walter Hunt invented the curved, eye-pointed needle for the sewing-machine years before Howe thought of it; but Hunt neglected to take out a patent for it in time, and when he applied for one it appeared that Howe, perhaps never having heard of Hunt's prior invention, had patented his own, and it was held that Hunt, although he had in the mean time perfected a good working machine, had forfeited his right by not having patented his invention or placed it before the public, and Howe's right to the needle was affirmed. A patent which has been granted will be invalidated if it be judicially established that the thing itself was not patentable, or that the patentee was not the real legal inventor, or that he had in any way forfeited or abandoned his right.

To guard the public against deception, every patented article must be marked with the date of the patent, and any person who shall mark as patented any article for which a patent has not been granted, or shall, without authority, put upon it the name, or imitation of the name, of any person who has received a patent, is liable to a penalty of $100 for each offence. In case of the infringement of a patent the law makes ample provision for the recovery of all damages which have been sustained and for the prevention of further infringement. If actual infringement is shown, it is not necessary that the infringer should have known of the existence of the patent. It is enough that he has infringed upon a right, and he must make good any damage which the patentee can show that he has suffered thereby.

American Patentees.—The Census Reports, while valuable in many respects, furnish a very inadequate idea of what may be styled the "Inventive Industry" of the United States. In 1870 only 352 persons were reported as "Inventors;" in 1880 "Designers, Draughtsmen, and Inventors" were classed together, the entire number being 2820. But every patentee must be an inventor, and it may be assumed that the majority of inventors are patentees also; for the man who has made an invention which he believes to be valuable will, in most cases, choose to avail himself of the rights secured by a patent. In some cases he may prefer to keep his processes a secret, but he runs the risk of their being discovered by some other person, who may use them as he pleases.

The number of patents issued in the United States is much greater than in any other country, in proportion to the population. The total number, up to the close of 1881, was 251,865. Previous to 1843 there were not quite 3000. In that year there were 510, the yearly number slowly increasing until in 1850 it reached 993. Thereafter the increase was more rapid until 1860, when there were 4778. During the civil war there was a diminution, but when peace was restored the inventive genius of the country came into new and larger exercise. In 1866 there were 9458 patents issued; in 1867 the number rose to 13,026, with some fluctuations from year to year until 1880, when there were 13,947. There was a marked increase in 1881, when the whole number of patents, certificates of designs, etc., was 16,584. The number of applications received at the Patent-office during that year was 30,242, each of which required more or less of special investigation, and of these 17,620 applications were favorably considered. Nearly 1000 patents during that year were granted to foreigners, and 15,118 new patents were issued to citizens of the United States, being about one patent to every 3300 of the entire population.

The ratio between the number of patents and that of the population presents some curious and not unimportant facts. It is much higher in the manufacturing States, gradually decreasing as agriculture predominates over manufacturing, and being least of all in the "cotton States." In Connecticut a patent was issued for every 898 of the population; in Rhode Island, one for every 994; in Massachusetts, one for 1367; in New York, one for 1584; in Ohio, one for 2099, being a little above the average proportion of the whole Union. The farther south we go the less do we find the industry turned in the direction of invention. In Virginia there was one patent issued to 14,005 of the population; in Georgia, one to 16,582; in North Carolina, one to 21,871; in South Carolina, one to 22,133; in Alabama, one to 26,861; in Mississippi, one to 27,559.

The special objects towards which the attention of inventors has been largely directed is worthy of note, indicating as it does some of the leading interests which have been found to remunerate labor thus laid out. A somewhat careful analysis of the Patent-office Reports was made in 1874, from which it appeared that of 168,947 patents issued up to that date, about 6500 were for improvements in spinning and weaving; 6000 for carriages and wagons; 4000 for fire-arms and explosives; 3500 for railway applications; 2500 for improvements in printing; and 2000 for sewing-machines and appurtenances.

The Index to the printed Records of the Patent-office for a single year makes a book at least four times as large as this volume. It gives, in two separate lists, alphabetically arranged, the names of the patentees and the titles of the patents granted to them, with the registered number of each patent, the day of its issue, and the residence of the patentee. Even from a volume apparently so dry as this not a few items of general interest may be gleaned, bearing upon our purpose of setting forth the condition and prospects of the various departments of American industry. The following are some principal subject-matters of the patents issued in 1881, with the number of separate patents for each of these subjects. It shows the chief directions towards which invention was directed. The same general facts would be shown by the Indexes of previous years. In 1881 patents were issued—

For air-compressing machines, 17; amalgamating apparatus, 32; axle-boxes, 40; axle-lubricators, 15; baling-presses, 30; barrels, 30; beds and bedding, 135; belts for machinery, 51; bicycles, 19; billiards, 21; boiler-furnaces, 22; book-holders, 22; boots and shoes, 156; bottles and bottle-stoppers, 90; bracelets, 40; brick-machines, 40; bridles, 15; brooms and brushes, 40; buckles, 50; burglar-alarms, 22; butter-making, 12; buttons and button machinery, 120; cans, 30; caps, 20; car-brakes, 70; car-couplings, 225; cars and car-attachments, 210; car-wheels, 25; carpet stretchers and sweepers, 45; carriages, 90; cartridges, 45; chains, 50; chairs, 50; churns, 70; cigars and cigarettes, 80; clocks, 50; clothes driers and washers, 40; coffee-pots and coffee-mills, 50; coffins, 15; corn cutters, shellers, etc., 60; corsets, 60; cotton gins, presses, etc., 50; cultivators, 90; curtain-fixtures, 30; dentists' apparatus, 30; desks, 25; doors and door-attachments, 50; ear ornaments, 15; egg-beaters, 30; electrical apparatus, 190; elevators, 50; engines, 70; faucets, 40; fertilizers, 20; files, 30; filters, 50; fire-alarms, 10; fire-arms, 75; fire-escapes, 25; fire-extinguishers, 50; fishing-rods, 15; fruit pickers, driers, etc., 60; furnaces and furnace-attachments, 120; gas and gas-lighting, 160; gates and gate-fastenings, 85; glass and glass-ware, 60; gloves and glove-fasteners, 30; governors for steam-engines, 35; grain reapers, binders, etc., 200; grates and grate-fixtures, 30; grist-mills, 50; hames and halters, 30; hammers, 20; harnesses, 35; harrows, 75; harvesters, 100; hats and hat-machinery, 70; hay forks, rakes, presses, etc., 60; heating-apparatus, 60; heel appliances, 20; hinges, 30; hoisting apparatus, 15; hoop-machines, 20; horse-detachers, 20; horse-power, 20; horse-shoes, 60; hose and hose-apparatus, 35; hubs, 30; hydrants, 15; hydraulic engines, 25; hydrocarbon furnaces, etc., 30; ice and ice-cream apparatus, 60; inks and inkstands, 15; insect-destroyers, 10; iron and steel making, 25; knitting-machines, 50; lacings, hooks, studs, etc., 25; ladders, 15; lamps, 50; lanterns, 35; lasts and lasting-machines, 35; latches, 30; lathes, 40; life-boats and life-preservers, 20; lifting apparatus, 25; locks, 60; locomotive-attachments, 60; looms and loom-attachments, 60; lubricators and lubricating attachments, 70; magnetic machines and appliances, 30; matches and match-boxes, 20; mechanical movements, 25; milk-coolers, etc., 50; mills and millstones, 75; mittens, 15; motors and motive apparatus, 70; mowers, 25; musical instruments, 70; nails and nailing-machines, 35; nuts, nut-locks, etc., 60; oil cans, cups, etc., 40; ore crushers, furnaces, etc., 100; packing for engines, 30; pantaloon-guards, 20; paper bags and boxes, 50; paper-making, 100; parers and corers for fruit, 15; pens and pen-holders, 45; photographic apparatus, 40; pianos and piano-attachments, 45; pins, 20; pipes for draining, etc., 50; planes and planing-machines, 25; planters for grain, 110; ploughs and ploughshares, 170; printing presses and apparatus, 100; pulleys, 40; pumps and pumping apparatus, 180; railway joints, ties, rails, etc., 80; railway signals, 40; railway switches, arresters, etc., 70; reaping-machines, 15; refrigerating apparatus, 90; rock-drillers, 25; rocking-chairs, 20; rotary engines, 30; rubber compounds, 30; saddles, 25; sashes and sash apparatus, 60; saws and sawing apparatus, 130; sawing-machines, 35; scales, 30; scarfs and adjuncts, 15; scrapers, 25; screws, 45; seats for carriages, etc., 20; seed-sowers, 50; sewage apparatus, 25; sewing-machines, 350; shirts, 20; shoes and appurtenances, 40; shutter-fasteners, 15; skates, 38; sleds and sleighs, 30; smoke-consumers, 15; soaps, 20; soldering apparatus, 40; spark-arresters, 30; spinning-machinery, 70; spoke-machines, 15; springs for beds, 30; steam-boilers, 45; steam-engines and appurtenances, 110; steering apparatus, 20; stoves, 200; sugar-making, 30; tables and appurtenances, 40; telegraphic apparatus, 130; telephones and apparatus, 200; thill-coupling, 40; threshing-machines, 45; fire-apparatus, 25; tobacco manufactures, 40; toys, 90; trucks, 35; trunks, 25; trusses, 15; type-writers, etc., 35; umbrellas, 20; valves, 130; vapor-burners, 20; vehicle-springs, 44; vehicle-wheels, 30; velocipedes, 50; wagons and appendages, 70; water-closets, 30; water-meters, 20; water-wheels, 20; weather-strips, 10; wells, 30; wheels, 40; wheelbarrows, 10; whips, 20; wind-mills, 50; windows, 30; wire-apparatus, 65; wood-work machinery, 30; wrenches, 25.

The foregoing partial list comprises several thousands of separate patents, but the whole number issued during the year amounts to more than 16,000, each of which is pronounced by the Patent-office authorities to be both "useful" and "new;" and the patentees of each of them had sufficient confidence in the paying qualities of the invention to induce them to prepare the necessary specifications, drawings, and models, and to pay the $35 required to obtain a patent. Quite suggestive, also, are many of the apparently trivial matters for which patents have been taken out. One would imagine that in the single year 1881 the whole field for inventive ingenuity had been gone over, but the records of any one of a score of years would present a very similar showing, all tending to evince that there is really no limit to the possible field. The following are some of the more singular things which were made the subjects of one or more patents:

Adding-machines, addressing-machines, advertising-balloons, advertising washboards, bag-holders, bats for tennis, batons for policemen, bean-cutters, beehives, billiard-cue tips, bird-cages, book-holders, boot-brushing machines, bouquet-holders, bottle-stoppers, bungs for barrels, candy-packages, card-frames, carpet-sweepers, carving-forks, cash-carriers, cattle-ties, cheese-hoops, Christmas-trees, cigar-lighters, closet-seats, clothes-pins, coops for poultry, corkscrews, curry-combs, decoy-ducks, doll-houses, dress-shields, drinking-cups, ear-piercers, exercising-machines, eye-glasses, fare-registers, feed-bags, fish-hooks, flower-pots, fly-traps, game-counters, garment-stretchers, garters, grub-pullers, gun-wads, hair-crimpers, hat-racks, head-rests, heel-plates, hitching-posts, hog-nose trimmers, incubators, ironing-boards, kaleidoscopes, knife-cleaners, lamp-extinguishers, lemon-squeezers, lunch-boxes, mail-bags, mop-wringers, moth-catchers, mouse-traps, overalls, pantaloon-guards, peach-pitters, picture-cords, pigeon-starters, pin-holders, poultry-crates, quoits, razor-strops, rein-holders, sample-stands, saw-setters, scissor-holders, screw-drivers, shawl-straps, shoe buttons and fasteners, shoulder-pads, skate-fasteners, sled-steerers, soap-bubble pipes, spectacle-cases, spittoons, stocking-supporters, suspender ends, swimming apparatus, teapot handles, ticket-cases, till-alarms, toy-pistols, toy-puzzles, toy-windwheels, travelling-bags, tuning-hammers, violin-rests, washboards, watch-guards, watch-winders, well-poles, whip-handles, whiskey-racks.

Number of Inventors.—Only an approximate estimate can be made of the number of living patentees in the United States. The number of separate patents issued during the last twenty years exceeds 200,000. Many persons have taken out only one or two patents, some from five to ten, a few have taken out several scores. The most prolific living patentee is Thomas A. Edison. The first record which we find of his name was in 1872, when he secured 33 patents, all relating to telegraphy. In the eight succeeding years the annual average was about 13, chiefly for telegraphs and telephones, until 1881, when he took out 69; so that in ten years the number of his patented inventions was 206—about one in every fifteen working days for the entire period—nearly all of them relating to electricity. The scanty accessible data indicate that there are in the United States more than 25,000 living patentees of "new and useful inventions." By far the greater number of these are regularly occupied in one or another of the professions, trades, or occupations, and are thus classed in the Census Report, and not as "inventors." Thus, Bogardus is probably included among "machinists," Ericsson among the "engineers," Edison among the "electricians."

Profits of Patents.—No approximate estimate can be made of the average pecuniary value of a patent. A few have netted millions to the inventors, or to those who have purchased rights in them. Among these are patents for sewing-machines, reaping-machines, railway-cars, India-rubber goods, and steel-making. Elias Howe, in 1846, took out a patent for a sewing-machine which embodied a claim for making a seam by the use of a curved eye-pointed needle. His own machines were far from successful, but this single specification of his claim covered something essential to the construction of any useful machine; and for the right to use this needle he received a large royalty from other manufacturers which for several years amounted to $200,000 a year. In all he received about $2,000,000 for the use of this invention. Several other patents for improvements in sewing-machines have been not less remunerative. McCormick's patents for reaping-machines have proved perhaps quite as profitable, and the list of very lucrative patents might be largely extended.

But, apart from such extraordinary successes, there are innumerable other patents, each of which has produced large incomes. Many of these, indeed, are for the cheap production of articles of which large numbers are sold, though the price of each one is very small. Matches may be taken as a good illustration of this class of patents. Not long ago a clever lady wrote, probably half in jest, "If some ingenious woman will invent a button that will stay upon boots, or something more lasting than the fasteners now in use, she will reap a large pecuniary harvest." Such an invention has been made and patented. It consists merely of a bit of slender, flattened wire, half an inch long, bent into a peculiar shape so that it can be passed in an instant through the eye of a shoe-button, which it will hold securely in its place. It is a very simple thing, but it is both "new and useful," and costs less than a penny; and, when one considers the number of shoe-buttons in constant use, he will comprehend that there is a competence if not "millions in it."

What proportion of the patents taken out are profitable? is a question easy to ask but difficult to answer. Some facts in regard to British patents may throw a little light upon the subject. In Great Britain, as has already been shown, it costs £25 to secure a patent for three years, £50 more to renew it for another four years, and £100 for a further renewal for seven years. Now of the 4000 or 5000 patents annually taken out, about 70 per cent. are allowed to expire at the end of three years, and of the remainder only 20 per cent. are kept up after the first seven years. This appears to indicate that not quite one-third of the patents have proved, or appear to be likely to prove, sufficiently valuable to make it worth while to pay £50 for a further four years' possession of the patent-right; and after the expiration of seven years only about six per cent. of the whole are worth £100 for seven years more. Many of each class probably have some value, but only the six per cent. of the whole belonging to the third class are thought to be worth £100 for a further seven years' exclusive possession of the right. A patent which is not worth that much cannot be regarded as a very valuable one. It is quite impossible to say how far this proportion of valuable patents holds good for the United States. It may perhaps be inferred that the much greater cost of securing a British patent deters many inventors from taking out patents who would have secured them could it have been done as cheaply as with us; otherwise it is not easy to understand why in Great Britain only one patent is annually issued for about 7000 of the population, while in the United States the ratio is one to 3300; this apparent difference is, however, partially offset by the fact that in the United States several separate patents are sometimes required to cover what in Great Britain may be included in one.

It must be borne in mind that the actual money value of an invention is not necessarily limited by that of the patent taken out for it, which merely gives it the additional worth of an exclusive right to its use during the unexpired term of the patent. If an invention is valueless in itself, the exclusive right to its use is of no value. The present worth of a valuable patent di-

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See Note 31.

minishes as the term approaches its close. The £75 paid for a British patent for seven years may have been wisely laid out, while the same amount—not to say nearly twice as much—would have been thrown away upon another seven years' extension. Or an invention valuable at one time may have become superseded by a subsequent one which produces the same result better or more cheaply. Or, again, the thing produced by the invention may have gone out of use. There have been patents for hoop-skirts which were lucrative a few years ago, but are now without value. If custom or fashion should proscribe the wearing of corsets, not one of the 60 patents taken out for them in 1881 would be worth a dollar. And again, an invention may have a great value, to which the exclusive right of using it would add little or nothing; no one but the inventor of it might ever have occasion to use it, although he may use it with great profit. It should not, therefore, be assumed that an invention is without use merely because a patent for it has no apparent value.

Circumstances often arise which give a high value to an invention where there had been no seeming use for it before. Take a single example: In 1843 Theodore Timby, a New York inventor, filed a caveat for a revolving turret for naval warfare, and afterwards, at intervals, obtained patents for "a revolving tower for offensive and defensive warfare," and endeavored to procure its adoption by the United States Government. Its practicability was admitted, but it was affirmed to be wholly superfluous, because the existing fortifications were far more than were necessary. He made several models of his invention, one of which was sent to the government of France and another to the Emperor of China, but nothing came of them, although in 1848 a Congressional Committee, of which Jefferson Davis was a member, made a favorable report upon this invention to the Secretary of War. Nothing was done in the matter until the outbreak of the civil war; then Mr. Ericsson planned the *Monitor*, an essential feature of which was Timby's turret, and for the right to use this $35,000 was paid by the constructors, with a further sum, amounting to $100,000 in all, for other vessels should they be ordered by the Government. Thus an invention which had remained unused for more than a dozen years with no profit to the inventor anticipated a great emergency and amply repaid him for his labor. And, moreover, had not Ericsson's *Monitor* proved an overmatch for the *Merrimac* in March, 1862, the history of our civil war might have been quite different from what it has been.

Upon the whole, there can be no doubt that in our country, where the cost is so slight, it is advisable that the inventor or discoverer of any valuable process or implement should secure a patent for it. The loss in any case will be trifling and the gain may be very large.

There is no danger that the field for profitable invention and discovery will ever be exhausted; on the contrary, it widens before us, day by day, in manifold directions. We are only beginning to discover the uses to which electricity may be put; not a week passes in which chemistry does not provide some new uses to which the most common materials may be profitably applied; and the man who discovers any such use has only to thank his own lack of sagacity if he fail to reap the reward. Nothing which has a demonstrable money value need be long without finding a purchaser for all that it can be shown to be worth. In the department of mechanics there is no limit to the invention of new devices and the improvement of old ones.

In *Harper's Magazine* (December, 1874, January, February, March, and April, 1875) is a series of exceedingly instructive papers on the "Mechanical Progress of the United States"* during the first century of our national existence. It passes in rapid review over the main inventions and discoveries which had, up to that date, not only marked the progress of the American people, but had in no small degree contributed to it. But if any one will pursue the investigation through the eight or

* These papers are by Mr. E. H. Knight. They are collected in a volume entitled *The First Century of the Republic: A Review of American Progress*, which also contains papers by fifteen other writers of the highest eminence in their several departments, the whole constituting a historical work of unusual interest and value.

nine years since that time, he will see that during no previous period has our progress in this direction been so marked and decided.

Requisites for an Inventor.—The inventive faculty in any department is to a great extent an original endowment of nature. Great inventions sometimes appear to be the immediate result of accident, but such fortunate "accidents" occur to those only who are capable of understanding them. Galileo was not the first man who had seen the swinging of the lamp suspended from the ceiling of a church in Pisa, but he was the first one to whom that common accident revealed that all the oscillations of any pendulum were performed in equal times; and to his use of that "accident" we owe our clocks. Many inventions of the highest value have been made by men whose previous occupations lay in quite other directions—Arkwright was a barber, Cartwright a clergyman, Peele a farmer, Watt a mathematical instrument-maker, Fulton a miniature-painter, Whittemore a gunsmith, Whitney a law-student, Blanchard a nail-maker, Morse a portrait-painter. But all these men had the genius of invention, and accident did nothing more for them than the same accidents might have done for thousands of others who did not know how to avail themselves of them. There are well-authenticated instances where the essential thing needed to perfect an invention came to the mind of the inventor in a dream. Such is said to be the case with Amos Whittemore, the earliest great American inventor, whose patent for a wiring-machine for cotton and wool cards brought him $150,000 at the close of the last century. But we may be sure the minds of these men had been absorbed in the idea, and the dream was the outcome of intense waking thought.

To be a successful inventor one must first find out some want, either already existing or which may be created, and then search for the means of meeting that want. He only avails himself of natural laws, and he must find out what are the laws which apply to the case in hand. He must know, for example, that no combination of wheels, springs, and levers can create power; that no watch will run unless it is wound up, and that it will stop when the force, external to itself, is expended. Then, when he knows what *cannot* by possibility be done, leaving that aside, he must consider what *may* possibly be done; and between the certainties on either side there is a wide limit of possibilities. Not everything which has been assumed to be impossible is really so. The philosophers of Salamanca agreed with Columbus that a ship might perhaps sail half-way round the globe and so reach the antipodes; but they maintained that it could never get back again, because, in order to do so from either direction, it must sail up a hill whose height was equal to the diameter of the globe—a most manifest impossibility, according to their conceptions. In the first year of this century Jacquard invented a machine for weaving nets without the use of a shuttle. Inventor and machine were brought to Paris and underwent an examination by Bonaparte, then First Consul, and Carnot, his able Minister of War. "Are you the man," sneered Carnot, "who pretends to do the impossible—to tie a knot in a stretched string?" Jacquard was not long in showing that his machine would do that very thing—the assumed impossibility was quite possible. A hundred men may have wholly failed to do a thing, while the next one may succeed, and the line between failure and success may be an almost imperceptible one. Very often one's own failures or those of others are guide-posts on the way towards success. Quite as many men have failed from disheartenment in following the right path upon which they had entered, as from attempting to proceed in some wrong direction. If one has good reason to believe that he is upon the right track, let him persevere, and do his best to go ahead—Mr. Faintheart came no nearer the Celestial City than did Mr. Obstinate.

The better a person is acquainted with what has been done or left undone by others the more likely is he to succeed as an inventor. An inventor often spends months or even years in perfecting a device for a certain purpose, and when he has done this and applies for a patent he learns that his invention had been anticipated by some other device, either identical with his own or similar to it in some essential respects. All his labor, in that case, has been thrown away. Not only is he debarred from obtaining a patent, but he cannot even make use of that which he honestly believed to be his own invention, for some one else had forestalled him in it and had already received the exclusive right to its use. It is hard enough for one to find that he has failed to accomplish what he had in view, but it is still harder to discover, after one has succeeded in doing what he hoped to do, that the work has all been thrown away. This caution is especially applicable to mechanical inventions.

The application for a patent demands great care. The "petition," which must be in writing, must state upon oath that the applicant believes himself to be the inventor; and this must be accompanied by a full description of the invention, with drawings or models if the case admit of it. The specifications must be so clear and definite that any person versed in the matter would be able from them to make use of the invention. If it be for a composition of matter, specimens of the ingredients must be furnished; if it be for a machine, the best mode of working it must be set forth. The essential thing is, that the description be full and intelligible, setting forth just what the inventor claims to be new. If anything claimed is not new, the whole patent will be voided thereby: a patent defective in one point is defective in all; but provision is made for remedying any error that may have been committed inadvertently and without fraudulent intent. A patent-right, being wholly an artificial one, is not only created by law, but is limited by law; and, while it behooves the inventor to be acquainted with the general aim and scope of the patent law, it is usually unwise for him to rely solely upon his own knowledge in drawing up his specifications and claim. There are lawyers and patent-agents who make this their specialty, and it is far safer in most cases for the inventor to consult with such a person. Cases are numerous in which applications are refused, or even patents already granted are declared void, by reason of defects or ambiguity in the specifications.

There is no reason to apprehend that the future will be less favorable for the exercise of the inventive faculty than the past has been. During the past ten years more valuable inventions were made in the United States than in the whole preceding century; and there is every ground to believe that the coming decade will repeat the story of the last in innumerable forms. Those who lead on the advance in any direction, or who in any good degree contribute to it, will, if they are sagacious as well as ingenious, be the ones to profit by it. The law of patents gives them abundant facilities and all needed protection. If they have the wisdom to avail themselves of their opportunities, they may reasonably expect to reap abundantly the harvest of the seeds which they have sown.

CHAPTER XXXVI.

MINOR PROFESSIONAL AVOCATIONS.

THE leading professional occupations—Divinity, Law, Medicine, and Teaching—have been considered in a previous chapter. There remain some others which must not be passed over.

THE STAGE—dramatic and lyric—affords a desirable avocation for far fewer persons than would be supposed from the prominence which it holds in the press and in conversation. The Census of 1880 reports 4812 professional actors, of whom 2992 were males and 1820 females, only 63 of both sexes being under the age of fifteen. The number, however, has much more than doubled since 1870, when there were 2053 actors, of whom 692 were females: the number of females upon the stage having thus more than quadrupled within ten years. This great increase is owing to a marked change in the character of the plays presented—the spectacular character, in which the exhibition of the person and gorgeousness of costume, to no small extent, take the place of dramatic representation. The above figures do not, however, include all those who appear on the stage in spectacles and the like, and who are also engaged more or less in other occupations.

There is a peculiar fascination surrounding the stage, of which only the illuminated side is presented to the uninstructed spectator. To him or her it seems that no life could be happier than that of representing the heroes or heroines of the drama, cheered on by the plaudits of the spectators. Nothing would seem to be easier than to pronounce with proper tones the words of the dramatist, accompanied by appropriate attitudes and fitting gestures. Then again, there is a current impression that the earnings of actors are very large. It is bruited about that this professional star or that receives for an hour or two of a week's evenings more than most men and women can earn by the steady industry of a month, six months, or a year; or that this or the other foreign celebrity has paid us a professional visit of a few months, and gone home with tens or hundreds of thousands of dollars. All this may be true—and pity it is so—in a few isolated cases; but, taken in the aggregate, there is no doubt that the average net earnings of actors are very small, and their necessary expenditures for costumes and general outfit are very large, while the occupation is a very precarious one.

Mere pecuniary considerations are not the only ones to be regarded in choosing an occupation. The healthfulness of it is to be carefully looked at, and moral soundness is assuredly of quite as much value as bodily healthfulness. Now, whichever it ought to be or might be, it is a conceded fact that the social and moral surroundings of the stage are, and always have been, bad. We do not deny — on the contrary, we most directly and gladly affirm — that there have been, and now are, men and women on the stage of noble character and pure lives. All the more honor to them that they have passed, and are now passing, unscathed through a fiery ordeal.

It would perhaps be a thankless task to attempt to dissuade those who have, or fancy that they have, high dramatic talent from going upon the stage, if the opportunity presents itself; but all experience and observation show that by far the greater portion of these will find to their sorrow that they have sadly mischosen. It need hardly be more than intimated that this is true of women even more emphatically than of men. It is not easy to conceive of a position more fraught with peril than that of a handsome young woman when she first becomes an actress. The path upon which she has entered is a perilous one, marked through its whole course by the monuments of blighted hopes and ruined reputations.

The lyric stage, or opera, presents some special characteristics worthy of note. The possession of an exceptionally fine

JACQUES CARTIER SETTING UP A CROSS AT GASPÉ.

See Note 32.

voice, especially in a young girl, is a prospective mine of wealth; but it has come to be accepted as an axiom that the voice can be thoroughly cultivated and developed only under some one of a few foreign masters in Italy, France, or Germany. This culture must commence early, and at that age when the pupil is passing, or has just passed, from girlhood to womanhood. The girl who goes abroad for such instruction, unless she can go surrounded by home influences, runs a fearful risk—one which should be well calculated at the start. The position of *prima donna* in opera or the concert-room is beyond all question a brilliant one; but if one will read the biographies of famous songstresses, as well as of famous actresses, there will be found abundant monitions that it is often purchased at too high a cost.

Music Teachers and Musicians.—It is coming to be more and more recognized that singing should be a part of our elementary education, and probably a considerable proportion of the teachers in our schools can give some instruction in this. There is no good reason why instruction in instrumental music should not be more widely diffused than it is. Perhaps it will not be possible at present to introduce this into primary schools; but in those of a higher grade—those in which a piano is a part of the apparatus—such pupils as show an aptitude should be taught to play upon this as well as to listen to it. In private schools, girls, as a rule, are taught to play; boys rather as an exception to it. A comparison of the Census Reports for 1870 and 1880 will indicate the advance made in this direction. In 1870 there were 16,010 professional musicians and teachers of music; in 1880 there were 30,477—an increase of 90 per cent. This increase of teachers, in a ratio three times greater than that of the population, implies a somewhat corresponding increase in the number of pupils. The Census of 1880 does not discriminate between professional musicians and teachers of music, but in 1870 there were reported about three of the latter to two of the former; and it may be assumed that the proportion has not been essentially changed. The former were almost wholly males; of the latter a considerable majority were females. Taking the two together, there were, in 1880, 17,295 males, 13,182 females.

Many male teachers of music are also musicians—that is, they practise their art, as well as give instruction in it, as a remunerative occupation. They perform not only in public concerts, but for private companies, and are paid for their services. This is rare with women, but there is no reason why it should be so. There are great musical compositions which require the compass of the opera-house or the concert-hall, but apart from these there is no place in which music can be so thoroughly enjoyed as in the parlor; and there are teachers of music who, while they lack the nerve and force of execution requisite for the concert-room, are abundantly capable of executing parlor music. Why should not these hold themselves ready to sing or play, and charge a fixed and stated price for so doing, precisely as they do for giving lessons? They would be all the better teachers for being able to practise their art for direct gain and without undergoing the weary routine of imparting the rudiments and correcting the errors of their pupils. Here, indeed, as it seems to us, is an almost untried and yet quite feasible opportunity for professional teachers of music, and more especially for women.

THE PLATFORM.—Some fifty years ago an enterprise was set on foot which seemed likely to result in a decided change in our modes of amusement and popular instruction. In almost every city, town, and village, associations were formed which undertook to provide for a succession of lectures or recitations from persons who, it was thought, were able to amuse or instruct a miscellaneous audience. The name of "Lyceum" was applied to this system of associations. These lectures have been productive of good in many ways. The lectures of such men as Silliman, Agassiz, and Mitchel did much to popularize science, and for a time it seemed as though nearly every brilliant or profound writer—and not a few who were far enough from being profound or brilliant—had joined the Lyceum. Curiosity had very much to do with this. People naturally wished to see and hear men who had made themselves famous or even notorious, and more especially if they came from abroad. Crowds thronged to see and hear Kossuth and Dickens, Thackeray and Tupper, Gavazzi and Oscar Wilde. But the Lyceum has fallen far short of becoming what it was expected to grow into. The "lecturers" as such numbered only a few bright names; those of Emerson, Gough, Lord, Wendell Phillips, and Anna Dickinson, in effect make up our list of popular lecturers, distinctively such. But there are not a few who have found lecturing highly remunerative as a subsidiary occupation; among such are Bayard Taylor, Chapin, Beecher, Curtis, Holmes, and Saxe.

The really popular lecture—the one which will pay—is a special kind of composition. A profound essay—unless Emerson's are to be made an exception—is not a lecture. Yet a lecture must bear reading as well as hearing, although it is to be heard rather than read. It must have points. A single dull or heavy passage in a discourse of an hour is inadmissible. If one is to repeat a discourse a score or perhaps a hundred times, and be paid for each repetition, he can afford to put into it his best thought, expressed in his best manner. The popular lecturer, moreover, should have an attractive delivery. His first aim is to please, and positive instruction is a secondary purpose. There are very many men who may be wholly incapable of writing a profound and exhaustive book on any subject who yet have thought enough upon many subjects to enable them to produce several attractive lectures which, properly delivered, will put money in their purse. This topic will be further considered in the chapter upon Popular Amusements.

Canvassers and Agents.—The selling of wares by travelling agents is coming more and more into use. In many cases it is of decided convenience to the purchaser, doing away with the necessity of his visiting the great markets whenever, at a loss of time and money, he has occasion to replenish his stock. It is quite as easy for one commercial traveller to visit a hundred customers as for any one of these to visit the warehouse of the wholesale dealer. The travelling salesman holds a more responsible position than the resident one, for he more fully represents his principal, and acts less immediately under his personal direction. As a matter of fact, the merchant sends his most capable and most trustworthy clerks as commercial travellers.

The book-trade is, in important respects, especially adapted to this method. The purchaser of groceries or dry-goods knows pretty nearly what there is in the market, and what and how much of it he wants. Most of those who would be buyers of books labor under a disadvantage in this respect. In cases not a few the buyer does not imagine that he needs a book at all until he has seen it; or, if he happen to know that he needs a book which would give him this information or that, he rarely knows what that book is, or which is the best of several of which he may have heard. It happens continually that what was once the best attainable book upon any given subject is so far inferior to one which may now be had as to be practically worthless. It is not many years since Calmet's "Dictionary of the Bible" was an indispensable part of a clergyman's library. It is now little better than none at all, simply because M'Clintock and Strong's "Cyclopædia" is infinitely its superior. The professional man may be presumed to keep himself fairly posted in the literature of his profession; but comparatively few people are in a position to know what books would be useful or even interesting to them. It is a part of the business of the travelling bookseller, as the canvasser or book-agent should be styled, to supply this information. Those who should be his customers will not come to him, and he must therefore go to them. If he can show them that such and such a book will be useful to them or their families, they will purchase; but not otherwise.

The first requisite for success is that the book which he hopes to sell is really a good one. The times are pretty well past when mere trash can be palmed off upon the public. If a man has been once deceived in that way he will in the future steer clear of the person who has cheated him. One chief guarantee that a book is a good one is that it bears the imprint of a responsible publisher; for it may be safely assumed that such a publisher will not risk his business reputation by issuing a book which he has not taken care to assure himself is a good one of its class. Every important publishing-house has in its employ a corps of "readers," thoroughly versed in the various departments of knowledge, whose special business it is to make a careful examination of such books as are laid before them for that purpose. In case the book be one of importance, and especially if it is to be offered to the public through canvassers, it will most probably be examined and vouched for by more than one critical reader. The publisher cannot afford to run any risk upon this point. The judicious canvasser will be chary of undertaking to work for any publisher whose name is not a warranty for the value of the book. More especially is this the case when the work is to be put forth in successive parts. It is by no means rare that such a work is well begun but poorly continued and finished. The canvasser is in a wide sense a guarantor of his principal to the purchaser.

It is not to be expected that the canvasser will be acquainted with the entire range of books which are offered for sale, but it is indispensable that he should be thoroughly acquainted with the merits of those which he offers. It is not enough for him to assure the person whom he approaches that the book has merits; he must be able to point out what those merits are, and how the work will be useful to this particular individual. Some kinds of books are useful to every one. To no intelligent person, for example, can the history of his own country be otherwise than desirable. The travelling bookseller may very safely assure every person that a well written American History is worth to him far more than its cost, while he would not try to urge a book relating to cattle-raising upon a city clergyman.

The canvasser must needs be a man of good address. There are some men whose first appearance is a letter of recommendation, and others who bear the imprint of "bore" upon their foreheads. One's first thought upon being accosted by such a man is how to get rid of him the most speedily, and the readiest way is to give a curt "I don't want it," when invited "Just to look" at any article—say a book, or the prospectus of one. The canvasser must be careful not to expose himself to this preliminary rebuff, which will, in four cases out of five, be a final one. On the other hand, the battle is half won when you have brought your auditor to the point of looking carefully at what you have to offer, and hearing what you have to say—provided always that you have something to show worth his looking at, or to say worth his listening to.

Nothing can be more erroneous than the idea that a man who has failed in everything else can pick up a livelihood as a canvasser. His occupation is one that demands superior ability, one every way honorable, and one of which he has just reason to be proud. He brings before a large number of persons, who would not otherwise have known of them, works which it is for their advantage to possess, and he undertakes to point out their merits. If he succeed he has done them good service. The great Bacon said of one of his works: "These are the meditations of Francis of Verulam, which, that posterity should be aware of, he deemed for their benefit." The travelling bookseller might, in the same spirit, say to his auditor: "This is such and such a work, which, that you should purchase, I deemed for your benefit."

It has been shown that the occupation of a canvasser requires for high success some high capacities, and affords a wide scope for their exercise; but underlying all these is that of personal character. Few men are brought into such immediate personal contact with those with whom they transact business. The ordinary purchaser must, in a great measure, take the merits of a book upon trust. Usually he knows nothing of it until the canvasser has brought it before him. He can know but little of it until he has read it, or at least enough of it to show him that it is not worth reading; and if he find that he has been deceived he will be pretty sure not to be taken in again by the same person.

That a canvasser is of known good repute is a great point in his favor. Other things being equal, it would be well for him to work in a region where he is known; but if, for any reason, it is advisable for him to operate elsewhere, he should go there well recommended. The mere fact that he is engaged with a publishing-house of acknowledged repute is of itself a letter of introduction and recommendation. It shows that they place confidence in him, and it may be fairly assumed that they have not done so without good reason. It is not likely that he will go to any district in which there is not somebody who is acquainted with him, or some one who knows him: a letter of introduction from that person is in every way desirable. A general letter of favorable introduction is a good thing, but such a special one is worth securing. One such acquaintanceship naturally leads to others. It is like a pebble dropped into the water: the ripples succeed each other in ever-widening circles.

It is altogether a mistake to look upon this occupation as necessarily a mere temporary one, to be taken up for a time when one is, as the phrase goes, "out of employment," and to be laid aside as soon as something else turns up; yet such temporary employment is not unfrequently desirable and sometimes unavoidable, and there are few avocations in which spare time may be more profitably utilized; but the business may be made a permanent one. This business will certainly be carried on by some one, and men naturally prefer buying of those from whom they have been accustomed to purchase.

There is one thing characteristic of book-buying more than almost anything else—the desire for reading grows with its gratification. When one readable book has been introduced in a family, the members will not long be contented with that. A source of enjoyment hitherto unknown has been discovered; the single book first bought is apt to be the beginning of a fair collection. Then, again, the desire for books spreads from family to family throughout an entire neighborhood, especially among the rising generation, who are almost unconsciously growing up in an atmosphere of books. Two generations ago it was an almost exceptional case when a dozen books were to be found in a fairly well-to-do country dwelling in New England. There were not more than this number in the house of the father of him who writes these pages. The clergyman of the village had one of the best libraries in the county, yet it was all held in one little room. History was represented by Rollin's "Ancient History," Hume's "England," and Weems's "Life of Washington."

In fiction there were "Thaddeus of Warsaw," the "Scottish Chiefs," and one or two of Scott's novels. In poetry there were "Paradise Lost," Thomson's "Seasons," Campbell's "Pleasures of Hope," Akenside's "Pleasures of the Imagination," and Byron's "Bride of Abydos." It was a great day for the village when a newspaper was set up there, and the printer, who was also the editor, opened a "Circulating Library," containing not less than three hundred volumes of miscellaneous reading. There was not in the region anything like such a collection, unless it was in the library of Middlebury College, twenty miles distant. It would be a curious matter to find out how many books are now to be found in this district.

The bearing of all this upon the subject in hand is evident. This immense increase in the demand for books is in no small degree owing to their introduction by canvassers; and the same thing is now going on still more notably all over the country. A thoughtful writer avers that the fact that our Western States grow up into civilization without passing through a period of barbarism is to be attributed more to the efforts of missionaries than to anything else. Quite as much, we imagine, is it owing to the itinerant booksellers who have created the present desire for literature, to satisfy which the future will present great opportunities for canvassers. The avocation, judiciously prosecuted, is now a lucrative one, and there is every prospect of its becoming more so. This is probably the most systematic business in which one can embark, and therefore success is more certain than in mercantile enterprises. Failures in other lines generally result from lack of system; in the subscription-book trade from lack of ability.

CHAPTER XXXVII.

SUGGESTIONS FOR RESEARCH AND INVENTION.

THE paths to success in life have been pretty well marked out in many directions by the foot-prints of those who have gone before us. One can now estimate, with an approach to accuracy, what he may hope to earn by agriculture, or in any of the usual trades and professions. Of course, exceptional cases continually occur. Now and then a man discovers an oil-well upon his farm, or finds veins of silver in the rocky ledges of his pasture. Now and then a single invention proves a mine of wealth; or a series of well-planned or lucky adventures in trade or speculation make him a millionaire. But lying between these extremes, upon either hand, there is a wide field traversed by numerous paths, not a few of which give promise of abundant reward to those who shall wisely enter upon and pursue them. Some of these have already been spoken of with more or less detail. It is here proposed to speak of others of this class.

Silver and gold, iron and copper, lead and zinc, are found with us in abundance. But tin, which is quite as valuable as copper, lead, or zinc, has been supposed not to be found in the United States in any appreciable quantities. We import from Great Britain block tin and tin plates to the amount of some $20,000,000 a year. Since the census year, 1880, it is affirmed, large deposits of tin ore have been discovered in California. As we are writing this chapter (September, 1883) a committee of the United States Senate, appointed to investigate the condition of education and labor, is in session in New York. One witness, whose position ought to insure the accuracy of his statements, testifies that "California's supply of tin ore is larger than that of England, and the quality is better." He adds, "We are the largest tin-consumers in the world, and our manufacture of tin plate is practically nothing. The establishment of this industry would afford employment to 40,000 additional working-men, involving the payment of at least $4,000,000 a year in wages." If tin ore does exist with us in considerable quantities, it forms an item in our national wealth upon which we have never counted.

Aluminum is a metal of which no man ever heard sixty years ago; yet it is more widely diffused through the crust of the earth than any other mineral, forming the substance of our clays, slates, and feldspathic rocks. It is never found in nature alone, but exists in combination with not less than two hundred other substances. Its oxide (*alumina*) is found impure as emery; when pure and crystallized it is called corundum, the hardest known substance, except the diamond; when colored with chromium and other substances, this corundum becomes sapphire, ruby, topaz, amethyst, etc. Alumina consists of about fifty-three parts of aluminum and forty-seven of oxygen. Our common clays contain alumina, sulphur, and potash or ammonia. Aluminum was first obtained as a metal in 1828. It is very ductile, almost as malleable as gold or silver, an excellent conductor of electricity, and not readily acted upon by any of the ordinary acids; it is of a bluish-white color, and less than one fourth as heavy as lead. When first produced it cost its weight in gold; it costs now about half its weight in silver. Its chief present use is for the production of alloys. A fusion of ten parts of aluminum and ninety of copper forms a kind of bronze finer than any brass, and especially adapted for gun-metal, the bearings of machinery, and all ornamental metal-work. An alloy of one part of silver and two parts of aluminum is equal to standard silver in all respects, and better in some, for spoons, forks, and all kinds of table service. The comparatively great cost of aluminum prevents its use for many purposes for which it is especially adapted; but eminent metallurgists are fully convinced that cheaper methods will be found for the production of the metal from its compounds. Some of them look for this result to electro-magnetism. The sources

HOME DECORATION.

See Note 33.

from which aluminum may be derived are so abundant, and the uses to which it can be applied are so numerous, that they are sanguine enough to believe that it will become the most important of all metals—superseding iron for very many purposes.

Magnesium, the metal of which *magnesia* is the oxide, is an element widely diffused in nature. Among the more common magnesian rocks is serpentine, which usually contains about twenty-six per cent. by weight, or thirty-five per cent. in bulk, of magnesium, and sometimes still more. It is also abundant in the water of the ocean. A tank of sea-water fifty feet square and one foot deep contains at least two thousand pounds of metallic magnesium. This metal is silvery white in color, very brilliant, ductile, and malleable, melting at a red heat, is easily cast into ingots, and does not rapidly rust in damp air. It is the lightest of known metals, the specific gravity being less than twice that of water, or one tenth that of gold. The existence of magnesium as a metal was first discovered about 1830, and the amount produced is still very inconsiderable—not more than a few tons in all. When drawn into a fine wire it can be ignited, and burns with a very brilliant white light. A wire one one-hundredth of an inch in diameter burns at the rate of a yard in a minute, the weight being only two grains, affording a light equivalent to seventy-four stearine candles. Its principal use is for illuminating purposes, especially as an artificial light in photographing. It has been suggested that "should magnesium be procurable at a much less cost than at present, it may serve as an excellent material for furnishing light where great intensity is required, especially in lighthouses." Professor Wurtz, one of the ablest American chemists, says: "Magnesium, being by far the lightest known substance of equal strength (except, possibly, *calcium*), and obtainable in unlimited quantities, is unquestionably—next to aluminum—the most important of the metals of the future." He adds: "It is not easy to comprehend our almost absolute inaction in the way of bringing into common use this class of metals, which will hereafter be far more valuable than any other materials known to mankind." The high cost of these metals is the only obstacle in the way of their extensive use. Professor Wurtz suggests that "a modification of the magneto-electric engine will undoubtedly give us currents of electricity strong enough and cheap enough to make these metals by direct electrolysis." Among the uses to which one or both of these metals would be at once applied, if they could be produced cheaply enough, would be that of telegraphic wires, for which they are especially adapted by their strength, lightness, ductility, and high conducting power. Here is a field eminently inviting for chemical research and experiment.

Reference has already been made to the opportunities afforded by Chemistry for reaping the highest pecuniary rewards. A whole volume would not suffice to comprise even the names of the chemical discoveries which have within our own days not only benefited the public, but enriched their originators. Products of great value have been derived from substances before considered worthless, and new products have been evolved from well-known articles: such as glucose from corn, celluloid from gun-cotton, vaseline from petroleum, stearine from lard, paraffine from coal, shale, peat, petroleum, fats, oils, etc. The greater part of our medicines, as administered, are the products of the chemist's laboratory; and many of the perfumes and flavoring extracts which gratify the smell or the taste are artificially procured from materials otherwise worthless. Electro-magnetism is a department of chemistry, and mighty as have been recent achievements here, the exploration of this field has hardly been begun.

Perhaps no art has been more indebted to chemistry than that of dyeing. Very few, indeed, of the natural vegetable or animal dyes can be rendered permanent without the aid of the chemist. Most of the mineral dyes are the artificial products of chemistry: blues from iron; yellows from lead; greens from arsenic, copper, and chromium, etc. Not a few of these dyes are highly poisonous, and therefore to be avoided. Within about a quarter of a century chemistry has produced a series of artificial colors which has almost revolutionized the art of dyeing. They are grouped together as "aniline colors" (the term being derived from *añil*, the Spanish name for indigo). Aniline was first produced by the distillation of indigo, but is now obtained from benzole, one of the products of the distillation of coal-tar. The first aniline dye was a brilliant purple; but they are now produced in all colors, under the various names of aniline, phenol, naphthaline, and anthracene colors, and their manufacture has grown into an important industry, the real originator of which was W. H. Perkin, an English chemist, who produced the first *mauve* aniline dye in 1856. The art of dyeing is of more industrial importance than is generally supposed. Besides its application to new fabrics of all materials, immense quantities of goods, the colors of which have faded or become unfashionable (either before or after having been made up), are re-dyed and re-dressed so as to be really fresh fabrics. Were it not for this the prices of many goods—especially those worn by women—would be much higher than they are; for when their colors came to be unseasonable or unfashionable the unsold goods would remain upon the hands of the manufacturer or dealer, who must take this risk into account when fixing the price. The cost of unsold goods must be defrayed from the profits upon those which have been sold. Unsalable goods are as valueless as uncollectible debts. The business of dyeing is one which seems to be capable of much extension. Not a few garments are discarded before they are half worn out, because their colors have faded; and double wear would be got out of them by having them re-dyed.

Cotton stands so indisputably at the head of the plants which produce *textile fibres*, and so large are the portions of the United States especially adapted to its growth, that it is hardly to be expected that any notable additions will be made to our existing industries in this respect. Possibly improvements may be effected in machinery adapted to the working of flax, so that linen cloth shall again take a place among our manufactures. Some species of hemp which flourish in this country have a valuable fibre; the possible use of one of these, the ramie plant, has already been noted.

So large and increasing is the consumption of silk goods in this country, so admirably adapted are many portions of our territory to the propagation and feeding of the silk-worm, and so easy is the labor required, that it is difficult to understand why it is that we are yet almost wholly dependent upon other countries for the raw material.

The wool of the sheep will undoubtedly remain the chief of our animal fibres; but there are other animals whose hair or wool possess special valuable qualities, and it is certainly worth ascertaining how far such animals as the Angora goat and the alpaca can be profitably naturalized in one section or another of the Union. Fur-bearing animals will become practically extinct before many years are past if their destruction continues to go on so rapidly. We see no reason why legislation might not provide more fully than it does against the wanton destruction of these animals, at least of the various marine kinds which bring forth their young upon the land. Their great breeding-places should be stringently protected, and the capture of the seal, during the breeding-season especially, should be prohibited.

Paper is an important factor in modern civilization. One may measurably estimate the civilization of a people by the comparative quantity of paper which it consumes. The United States ranks by far the first in this respect, Great Britain coming next. The consumption of paper in the United States has increased in a ratio far greater than the increase of population. The value of the paper manufactured in 1870 was (in gold) about $39,000,000; in 1880 it was $55,000,000, an increase of forty-one per cent.; but the cost per ream in 1870 was about one fourth greater than in 1880, so that the increase in quantity consumed was more than fifty per cent. Rags, which formerly constituted the chief material for paper-making, are now quite insufficient for that purpose, and attention has been turned in almost every direction to find new materials. The waste paper which has been written or printed upon is bleached and ground up for stock. All kinds of vegetable fibre have been more or less utilized for this purpose. Paper has been made from the fibres of the aloe, artichoke, asparagus, banana, basswood, bean-vine, bulrush, cane, cat-tail, clover, corn-husks, grasses of various kinds, hop-vines, osiers, reeds, rushes, sorghum, thistles, tobacco, wild rice, and many others. Among the materials of this class, apart from cotton, flax, and hemp, that which has been most successfully employed is the esparto grass, from which a very strong paper is made.

A kind of cane (*arundinaria macrosperma*) which grows abundantly in some of the Southern States furnishes an inexhaustible supply of material for paper adapted for many purposes. The mode of preparing this fibre is peculiar. The cane, after having been stripped and cleaned, is placed in large closed iron cylinders, called "guns," into which steam is introduced under a pressure of one hundred and eighty pounds to the square inch, for a quarter of an hour. The pulling of a trigger removes the cap from the muzzle of the gun, and the disintegrated cane is blown out in a mass of brown fibre, resembling oakum. The guns are twenty-two feet long, with a bore of twelve inches. One such gun will prepare from four to six tons of fibre in twenty-four hours.

The straw of all kinds of grain is very largely used in the manufacture of wrapping-paper and the lower grades of newspaper stock. Wood pulp is the most important recent addition to the materials for paper-making, and its use, especially in the cheaper kinds of printing-paper, is rapidly increasing. The processes by which the wood is converted into pulp are described elsewhere in this volume. Paper of very good quality has been made from peat. An admixture of from five to fifteen per cent. of clay is advantageous in most kinds of paper, giving a smoother surface, and rendering the sheets more opaque. Much larger quantities are often used in order to increase the weight, but the paper is made weaker and more brittle. It is advantageously used in large proportions in the pasteboard for boxes; and as it diminishes the combustibility of the article, it may be used to good purpose when paper comes to be employed for building purposes and for furniture.

Papier-maché ("pulp-paper") has long been used in China and Japan for many purposes for which we employ wood; and as lumber becomes more and more costly with us, the use of paper will be much extended. Its comparative lightness and toughness adapt it especially for the panels of doors, for light partitions, for the sides of railway cars, and the like uses. Mr. Clay, who introduced the use of papier-maché into England, acquired thereby an immense fortune; and there can be no doubt that fortunes are yet to be made in this direction. There is certainly room for the exercise of inventive genius.

Numerous and abundant as are the food products of the United States, we are still very far from having availed ourselves of all which may be produced among us. This is fully illustrated by the introduction of the sorghum plant. The Western Continent, when first settled by the whites, was singularly deficient in this respect. Corn and the potato are the only important food plants indigenous to America, and these, with tobacco and the cacao (chocolate) plant, make up the list of vegetable products for which the old world is debtor to the new. We have borrowed much more largely. All the other grains and all fruits (except the grape) which we grow have been naturalized among us; and not a few of them have here found soil and climate more favorable than those of their original homes. The matter has been already considered at some length in respect to fruits. Our National Department of Agriculture has done, and is doing, much to indicate the lines in which experiments may be prosecuted. One successful effort in acclimatization will more than repay the cost of a hundred failures.

There are several plants which would seem to promise much. The *maté*, or Paraguay tea-plant, is used in a considerable part of South America as extensively as tea and coffee are in other parts of the globe. The tree itself is a species of holly, closely allied to that which produces the *yaupon*, or "black drink," of our Southern aborigines, and it is not improbable that it might be introduced among us. Or, if not grown here, it might be advantageous to import it, as we now import tea and coffee, to which the properties of maté bear a strong likeness. The *coca* is a Peruvian plant, to whose leaves the most remarkable stimulant and narcotic properties are ascribed. We are told, upon what appears to be reliable authority, that "under its influence the Indians of Peru will work twenty or thirty successive hours without sleep; that they will travel more than two hundred miles in three days, consuming little food, but continually chewing coca leaves, which they carry in a little bag slung over their shoulders." The leaves themselves cost, on the spot, from fifty to seventy-five cents per pound, but it is said that two or three of them steeped will produce coca-tea enough for half a dozen people.

In the matter of many food products, the thing which more than most others calls for invention is better modes of preparing them for market. In the canning or drying of fruits, so as to preserve their flavor and enable us to have an abundant supply all the year round, there is a wide scope for invention. So, also, in the modes of desiccating vegetables, by which they may be preserved in a small compass without losing their flavor or virtues. Fish—especially salt-water fish—will doubtless come to fill a much larger place in our dietaries than it now does, both as a matter of health and of economy. To enable us to reap the full benefit of the boundless capabilities of the ocean as a source for the supply of animal food, we need better and more economical modes of "putting up" fish, lobsters, oysters, etc., so that they can be attainable at all seasons in the most inland points of our continent. The foregoing are only hints and suggestions as to a few of the objects to be aimed at by persons of inventive capacity.

The production, conservation, and distribution of heat presents a wide field for research and invention. In our present methods of warming buildings by grates, stoves, and furnaces, more than one half of the heat is wasted; and, in spite of all improvements in the steam-engine, a large percentage of the heat generated is not utilized. The combustion of wood and coal is the chief means heretofore employed for the artificial production of heat. Petroleum, weight for weight, contains much more heating power than coal, and is now used for many purposes to advantage; it may be safely assumed that means can be devised to obviate the defects which still exist, so that this liquid fuel will come more and more into use. Heating by gas has been proposed for adoption on a large scale. It has been suggested that the coal-dust, which absolutely forms mountains of waste fuel in the anthracite regions of Pennsylvania, might be converted upon the spot into gas, which should be conveyed in pipes to the large towns. There is no mechanical impossibility involved; and as this coal-dust amounts to not less than one fifth of the entire product of the mines, a vast saving of fuel now wasted might be effected.

Even upon a winter's day there is a very large amount of heat in the direct rays of the sun, and various means have been suggested by which this may be used for warming purposes. A very simple device is that of Mr. Morse, of Salem, Massachusetts. It consists of a surface of slate, three feet by eight, painted black, with flues leading into the room to be warmed, and placed against the wall outside of the building, so that the rays of the sun fall upon it as directly as possible. The apartment, which was twenty by fourteen feet, and ten feet high, was made comfortable during the entire winter, except on the coldest days. The inventor says that, "in general, a difference of thirty to thirty-five degrees can thus be secured during four or five working hours of the day."

Experiments and investigations upon a large scale have been entered upon for utilizing the rays of the sun as a motive power for machinery. At the French Exposition of 1878 M. Mouchet exhibited his solar engine. It consisted of a solar mirror, having a surface of about twenty square yards, and connected with a receiver. At the focus of the mirror was placed an iron boiler having a capacity of twenty-five gallons, in which was about sixteen gallons of water, the remainder of the space being left for steam. In half an hour the water was raised to the boiling point, with a steam pressure of five atmospheres, but under a clear sky the steam pressure was subsequently raised to seven atmospheres. A pumping-engine was attached to the boiler, and worked under a pressure of three atmospheres, raising from three hundred and fifty to four hundred and fifty gallons of water per hour to the height of six and a half feet. These experiments were made towards the close of September. Of course, the heat produced would have been greater on a day in summer. The adaptation of the mirror to cooking and domestic purposes was also shown. The veteran inventor, Mr. Ericsson, has for several years devoted much of his thought to the invention and perfection of a solar engine, from which the highest results are anticipated.

The various motive powers available for human use have called into exercise some of the highest inventive powers. Thousands upon thousands of inventions have been made in connection with the steam-engine and its appliances. Ericsson's caloric engine, although not successful where large power is required, is invaluable in cases where small engines are wanted. The capability of electro-galvanism as a motive power was first suggested some fifty years ago by Thomas Davenport, an obscure New England blacksmith, and was slowly developed by others, so that it has been profitably employed for working engines of low power. Within a few months it has been demonstrated that this power can be economically applied to engines sufficient to draw trains upon our street railways, for which purpose, at least, it is anticipated that it will supersede steam.

The use of compressed air as a motive power has received far less attention than it should have done. This can certainly be applied in many cases where steam would be inconvenient, or even impossible. Without it the Mt. Cenis tunnel could never have been excavated. The problem was to drill a hole some twenty-five feet in diameter through nearly eight miles of solid rock, rising for a perpendicular mile or more above the level of the tunnel, so that no shafts could be sunk even for ventilation. To drill by hand would have been practically impossible. All the men who could have found space to work upon the head of the drift could not have drilled and blasted through in half a century, even if they could have worked at all in such a hole. Drilling by steam-power was out of the question, for the steam-engine must have fire, and fire demands air, and no air could enter or leave except by the mouth of the tunnel. But, fortunately, there was a mountain torrent half a mile from the proposed mouth, furnishing abundant water-power. This was used, by appropriate machinery, for compressing the air, which was conveyed in pipes into the tunnel so as to work the drilling-engines within. This liberated air could only find an exit through the mouth of the tunnel, carrying out with it the smoke produced by the blasting. One drilling-engine, as large as a railway locomotive, worked nine drills, each giving two hundred strokes a minute, or eighteen hundred in all, each much heavier than a miner could deliver with a sledge-hammer. Not more than five pairs of miners could have worked at a time, each hammer-man giving twenty strokes a minute, or one hundred in all. This machine, therefore, did the work of fully twenty men, and could, moreover, be managed by relays during the whole twenty-four hours, while a gang of miners could not work more than eight hours.

Compressed air may be used to advantage wherever there is a superabundance of water-power, inconveniently located for manufacturing purposes; say, high up a mountain side, or in a deep gulch or ravine. A condensing-engine worked by a water-wheel might be placed here, and the compressed air be conducted in pipes for any required distance. There would be no mechanical impossibility in using the water-power of Niagara Falls to work engines in Buffalo, or even in New York. There is, indeed, a loss of absolute power, but this would be of no consequence in the case supposed, where there is unlimited water-power running to waste. It is estimated that the water-power of Niagara is as great as would be the steam-power produced by 266,000,000 tons of coal per year—a quantity equal to the entire consumption of the world.

Steam-power might, in many cases, be profitably used for compressing air. A large steam-engine can be worked at much less cost than a number of small ones having the same aggregate power. Such a compressing-engine might be located on the outskirts of any large city, or at any convenient point within it, and the compressed air—the equivalent of the steam—be conveyed in pipes, just as gas and water are, wherever wanted. Thus would not only the danger from fire and explosions be obviated, but much of the noise and jar of the steam machinery would be avoided. The compressed-air engine works almost noiselessly; and, moreover, the room in which such an engine works would of necessity be thoroughly ventilated. Unless this method shall

A SUNDAY MORNING IN SURREY.

See Note 34.

be anticipated by the electro-magnetic motor just mentioned, it would seem that our street railways must in time be operated by compressed air. The means for effecting this present no serious mechanical difficulties, and the man who shall devise a practicable compressed-air motor cannot fail to find a fortune in it. At present, we believe that this power, so easily developed and so entirely under control, is used for little else than for sending pneumatic despatches for short distances—a use which might be largely extended.

The force of the wind as a motor is quite too much overlooked in this country. It costs money to run a steam-engine, while water-power and wind-power cost little or nothing. Few men can have water-power upon their grounds, while the wind blows everywhere, if not always. The disadvantage inseparable from the windmill is its uncertainty. One cannot know positively when or how fast it will run. But in spite of this there are few regions where it may not be useful, and there are many in which it would seem to be almost indispensable. Such are all our great prairie lands, and those others where there is no available water-power. If there be a lake, pond, or still-water river near by, the windmill, when it will go, and if there is nothing else for it to do, may be kept busy in pumping up water into a reservoir, to be used for irrigation and other purposes. For pumping water from deep wells it is invaluable. Indeed, in many cases the reservoir might be large enough and high enough to furnish a considerable water-power, which would be available at all times. One cannot make the windmill work when there is no wind; but when it works at all it can be made to store up force in several ways. There are few large farms where one would not be worth much more than its cost.

A man somewhere on our great plains has worked out this general idea in another shape. Water is scarce with him, while sand is plentiful. His windmill carries an endless belt, provided with buckets, like a grain elevator. These dip into a large box of sharp, dry sand, and raise it into a reservoir at the top of the building, whence, by opening a sluice, it falls upon a large wheel like an overshot water-wheel, which it turns just as water would do. The sand is discharged from the wheel into the box from which it had been taken, and is thus used over and over again without limit. As many windmills can be put up as are required to lift the necessary quantity of sand. This sand-reservoir is, in effect, a dam for storing up the power, to be used when wanted. Here is a suggestion which may be carried out by any one, and almost everywhere. We do not learn that the inventor has patented his sand-mill; if he has not, he has missed a sure fortune.

CHAPTER XXXVIII.

BUILDING MATERIALS.

IN a preceding chapter it has been shown that great changes will be wrought in the character of our domestic architecture. The dwellings of the future will be very different from most of those of the past and many of those of the present. As we build more and more for health and comfort we shall build more and more durably. This involves a marked change in our building materials. Such a change would have been inevitable in any case; for, even with the wisest measures for the conservation of our forests, wood will become an article too costly to be generally used for exterior building purposes, and something else must be largely substituted for it. We shall still look to the surface of the earth for most of our food and for the materials for our clothing; but we must mainly construct our houses, as well as warm them and light them, from substances which nature has from the beginning been fashioning and storing up for us within the bosom of the earth. Coal and petroleum, stone and clay, iron and copper, are at hand to serve many of the uses for which wood has been heretofore used. Our mines will supply future generations that which our forests can no longer provide, more especially what is required for building purposes.

Stone will doubtless be used for most public buildings, and very largely for others, in those localities where good building-stone is readily and cheaply accessible. The present importance of our quarrying interests has been shown in a previous chapter. This importance must be greatly enhanced in the future. Any man who has a quarry of good building-stone, easily accessible, is richer than if he owned a gold-mine; and there are many such quarries quite unworked and even unsuspected; the valuable rock being more or less covered up by worthless deposits. Prospecting for a stone-quarry gives better promise than prospecting for gold or silver.

But there are immense regions in which houses must be built, where wood is already scarce, and where good building-stone is not found. Here other materials must be supplied. What they shall be depends upon circumstances. There are several kinds of "concretes" or artificial stone, many of which possess considerable value for building purposes if properly manufactured, and if employed within certain limitations. *Béton-Coignet*, of which the constituents are sand, hydraulic lime, and Portland cement, is used for the fluted columns of the interior of St. Patrick's Cathedral, New York, and quite largely for ornamental facings to brick buildings. *Ransome's Concrete Stone* is made by filling the interstices of sand, gravel, etc., with an insoluble cementing substance, most commonly silicate of soda ("soluble glass") and chloride of calcium; double decomposition takes place, resulting in the formation of chloride of sodium (common salt) and silicate of lime, which is the binding material. The *Sorel Artificial Stone* is made by mixing chloride of magnesium and oxide of magnesium, the result being oxychloride of magnesium, a very strong cement. The so-called emery-wheels, used as grindstones, etc., consist of this compound of magnesium. To form the building-stone, twenty parts of this cement are mixed with one hundred and twenty parts of sand and pounded marble, and the whole moulded into blocks. A cubic foot of this stone costs about sixty cents; but for many purposes large pebbles, or even cobble-stones, may be placed in the mould, forming the greater part of the block, and thus the cost may be reduced to ten or twelve cents per cubic foot. The *Frear Artificial Stone* consists of a mixture of silicious sand and hydraulic cement, with an addition of gum-shellac; but good authorities question the advisability of the last ingredient. "It yields," they say, "to the solvent power of the alkalies, and should be employed with great caution in localities exposed to such influences." *Portland Stone* is a mixture of Portland cement with sand and gravel, formed into blocks; its value depends upon the quality of the cement used. This is equally true of all kinds of artificial stone. General Gillmore, the highest authority upon this subject, says: "I am not aware that any good silicious or argillaceous hydraulic lime has ever been manufactured in the United States; and I know of no calcareous deposit capable of producing such a lime." It is certainly worth making diligent search to ascertain whether such deposits exist among us. If they shall be found, their future value must be immense. There is, beyond doubt, room for great improvements in the processes of the manufacture of artificial stone, and here is a wide field for research and experiment. There have been several attempts at building in concrete, that is, making the artificial stone into solid walls instead of blocks, to be laid up as masonry. Not improbably this may be successfully done, at least, for interior walls and partitions. Artificial stone in blocks is largely used for floors and pavements; and the concrete pavements are nothing but artificial stone made in masses and upon the spot, instead of being moulded into blocks and afterwards laid down. One great advantage of this concrete stone is that, like brick and terra-cotta, it can be moulded into blocks of any desired shape and dimensions, requiring no subsequent cutting or dressing to fit them to their places.

There is much room for the selection of the natural stones for building purposes. This depends upon the cheapness with which they can be furnished at the place where they are to be used; upon their durability, strength, and beauty. Some kinds of stone rapidly disintegrate when exposed to the action of the elements. Thus, the stone of which the British Parliament Houses are constructed began to decay perceptibly almost as soon as it was laid. It is usual, when any new quarry of stone is opened, to endeavor to ascertain the durability of the stone by chemical analysis, by boiling it in saline solutions, and by subjecting it to great alternations of temperature, freezing mixtures and heat constituting the means. But all such tests are of little value compared with a careful examination of the rock itself, as exposed in its natural outcrop. Such an examination will show that some rocks soften and disintegrate by weathering, while in others the angles and faces have remained sharp and hard through countless ages of exposure. Some rocks, indeed, are quite soft when first quarried, but continually grow harder by exposure. Such stone has a special value from this circumstance, since it can be worked with comparative ease when newly quarried. There are kinds of stone which are durable in an equable climate, and yet yield to a variable one. The obelisk recently erected in the New York Central Park was hardly injured by an exposure of twenty centuries to the almost changeless climate of Egypt, while it has been sensibly defaced by the frost and snow of two or three of our winters. The white marble, so beautiful for ages in Greece or Italy, becomes discolored in a few years in New York or New England. Many other conditions enter largely into the selection of a building-stone. One of the most important is the comparative ease with which it can be wrought. Thus trap-rock, although one of the strongest and most durable of all stones, is little used in building, because of the great difficulty with which it is quarried; and being very hard, and generally without cleavage, it is especially untractable under the chisel or hammer.

But while stone, natural and artificial, will enter more largely than it now does into our architecture, especially for large structures, we must look upon brick as our chief future building material in most localities. Brick, indeed, may be properly considered as a kind of artificial stone, in which some of the processes of nature have been imitated by submitting clay, moulded into convenient forms and sizes, to the action of intense heat, which renders the soft material as hard and durable as stone, and even less liable to injury from fire than almost any kind of stone. In some nearly rainless districts, "adobes," or bricks dried in the sun, answer a tolerable purpose. But bricks burned, or, rather, baked, form the material which we have in view.

All clays are not equally suitable for brick-making; many kinds are absolutely useless, and most of even the best kinds require some admixture of foreign substances. The essential ingredients of good brick-clay are silica and alumina. But bricks made from "fat clays" warp and shrink in burning, and require an addition of a greater or less proportion of sand, ashes, or cinders. If the clay, on the other hand, has too great a proportion of sand, the bricks will be brittle, and so an addition of other and "fatter" clay is required. If too much iron, with an excess of silica or lime, is present, the bricks will melt, instead of properly baking. If there be carbonate of lime, whether in the form of chalk, marl, or calcareous petrifactions, it is converted into quicklime in the process of burning, and only such portions as come in contact with the silica and alumina combine with these substances; the excess remains as quicklime, which will slack when the bricks are exposed to moisture, and so destroy them. Hence such clays as contain too great a percentage of carbonate of lime are altogether unfit for brick-making. Nor is the best clay in a fit condition for use when newly dug from the pit. It needs to be exposed to the weather until it becomes thoroughly disintegrated. Frost is the best agency for this purpose, and the longer the exposure, the more effectually is the clay reduced. There are few industries which call for more knowledge and sound judgment than that of selecting and tempering the clay for brick-making.

Moulding the clay into brick was formerly done by hand, but machinery is now largely employed; still, much manual labor is required in handling the brick in the various stages of manufacture. The standard at the great brick-yards at Haverstraw, on the Hudson, where the best machinery is used, and where the facilities for shipping are excellent, is one thousand bricks a day for each person employed, from the time when the clay is dug to when the bricks are placed on board the vessel.

The burning of the bricks is perhaps the direction in which improvement is most to be looked for. It is said that in the neighborhood of London bricks take about three months in the burning; at Haverstraw the time, a few years since, was about two weeks, requiring from thirty to forty cords of wood for one hundred thousand bricks. The time now required is three or four days, and the fuel is reduced to sixteen cords of wood, and a little coal-dust, mixed in the clay, costing about as much as half a cord of wood. With us, bricks are usually burned in kilns; in Europe permanent furnaces are also employed. It would seem that the principles of heating developed in Siemens' Regenerating Gas Furnace, so largely used in the smelting of iron and in the production of Bessemer steel, might be applied to the burning of brick, for the fuel forms a very considerable item in the cost of the product. There is a slight variation in the size of the brick made in different sections: $8 \times 4 \times 2\frac{1}{2}$ inches being about the average. We see no reason why the length and breadth should not be doubled, even though it may not be advisable to make any great increase in the thickness, on account of difficulty of thorough baking. Brick can be moulded in various forms, just as stone is cut, and much more easily. Terra-cotta ("baked clay") and tiles, whether plain or ornamented, glazed or unglazed, are only modifications of bricks. Both these are capable of innumerable applications in both interior and exterior architecture.

The substitution of brick and stone for wood in our dwellings will be accompanied by the use of iron for many purposes. We shall have iron beams and girders, possibly iron rafters. Building in more difficult materials, we shall build better, and more enduringly. Ornamentation will come to be more thought of, and decoration, not merely as applied to architecture, but as an integral part of a building, will be demanded far more generally than it has ever been.

The *Sand-Blast* is a new device for producing ornamental work upon any hard material, to the practical applications of which no limit can be assigned. It furnishes an interesting chapter in the history of American inventions. If one will turn to the Patent Office Reports for 1870 he will find, under date of October 18, the record of the issue to Benjamin C. Tilghman, of Philadelphia, of Patent No. 108,408, "For the cutting, boring, grinding, dressing, engraving, and pulverizing of stone, metal, glass, pottery, wood, and other hard or solid substances, by means of sand used as a projectile, when the requisite velocity has been given to it artificially by any suitable means."

A stream of sand falling with considerable velocity upon any hard, brittle substance cuts it away rapidly; the harder and more brittle the substance, the greater is the wear; while soft, tough substances are hardly worn at all. Let one put his finger in a moderate sand-blast, and the nail will be worn away in an instant, while the flesh is uninjured. Glass, stone, and brick are the substances which yield most readily to the sand-blast. Fasten a piece of the most delicate lace upon a plate of glass, and place it under the sand, and the parts of the glass not covered by the lace will be cut away to any depth, according to the duration of the exposure, while the parts covered by the threads, almost as fine as a spider's web, are untouched. Let a picture be drawn with liquid glue or any suitable material, upon glass, and every line will be reproduced. The parts worn down are roughened and semi-opaque, like ground glass, while the protected parts retain their polish. The pattern, whatever it be, appears in polished lines upon a "ground" surface. Colored glass usually consists of a thin colored layer upon the surface of a plain sheet. Upon this colored side produce any pattern, by drawing it with some thick ink, or otherwise; place it in the sand-blast, and this surface, where not protected, will be cut away, and the pattern will stand out in brilliant red (supposing that to be the color) upon a soft white ground. The initials, crests, monograms, and other devices now so common upon inside windows and glass-ware of all kinds are produced by the sand-blast. Here, it hardly need be said, is opportunity for high artistic skill in designing. The sand-blast will take care for the execution; for, like the camera of the photographer, it will execute the most elaborate work as easily as the simplest.

Work like this does not need more than a moderate velocity in the sand-stream. But there are other kinds of work which require a high rate. The apparatus is a kind of gun, loading itself automatically near the breech with fine sand, which is driven out through the muzzle by steam, under a pressure, sometimes, of four hundred pounds to the square inch. The machine is quite simple, but its use requires some skill. The sand-stream may be made to act as a plane, a drill, or a chisel. In quarrying, when a large block of stone is to be detached, the groove to separate it from the mass may be cut by the sand-blast more easily than by any other means.

The main use to which the sand-blast has been applied is for dressing and ornamenting stone, after it has been quarried. Under a steam-pressure of fifty pounds it will cut away five cubic inches of marble, or three of granite, in a minute. For ornamental work upon stone, the desired pattern is cut out in a sheet of india-rubber, say, one sixteenth of an inch thick. This is fixed to the face of the block, and the sand-stream turned upon it. The same pattern may be used over and over again upon different blocks. In one case a pattern had been used for fifty slabs of marble, each of which was cut down a quarter of an inch, or more than a foot in all, and yet the thin rubber pattern showed no signs of wear.

Blocks of stone may be turned by the sand-blast as easily as wood is turned in a lathe. The block is placed in the lathe, where it is accurately centred. The sand-pipe is carried along parallel to the axis of the block, by a sliding-rest, as the chisel is in wood-turning, and in a very short time the rough block is turned into a true cylinder. By the use of "chucks," as in turning irregular forms in wood, any similar form may be produced in stone with equal facility. It may require the labor of a fortnight to chisel a block of stone into the pilaster of a balcony. By the sand-blast, the same block may be turned into the same shape in half a day. The stone-work of the Philadelphia Academy of Fine Arts was executed by the sand-blast, not the chisel. Brick yields to the sand-blast as easily as stone; and if it is ever desirable to ornament a brick wall with carvings, the sand-blast furnishes a ready means. There is practically no end to the possible applications of this invention. It has already been made to round and dress mill-stones; engrave glass, metals, and execute wood-carvings; drill holes in all tough materials; and smooth off the rough surface of castings. The sand-blast will hereafter become a very potent factor in house-building, and especially so when quarried or dressed stone is employed for exterior or interior purposes.

The inevitable change in our building materials must work a considerable change in the distribution of labor among the different building trades. The proportion of masons and bricklayers must increase, that of carpenters must comparatively diminish. The tendency of machinery in house-building will be to dispense with unskilled labor rather than that which requires skill. The winch and pulley will do the work of the hod-carrier; mills may be made to mix and attemper the mortar; but we imagine that nothing short of direct human agency will spread the mortar to the varying thickness required, and lay the brick and stone plumb and true in their places.

CHAPTER XXXIX.

WORK FOR WOMEN.

WOMEN, as well as men, must live by labor performed either by themselves or by others; and the number of women is very large who must support themselves, wholly or in part, and not a few have others dependent upon them. It is beyond question that it is more difficult for women than for men to find employment at all remunerative, and when their work is of the same general character, their wages, as a rule, are much lower. In either aspect of the case the evil is a grave one, and much earnest thought has been directed towards it. The first thing to be done is to ascertain the magnitude of the evil.

In the Census Report for 1880 (as has been shown in Chapter III.) children below the age of ten (who constitute 18 per cent. of the population) are assumed to contribute nothing to their own support. Between the ages of ten and sixteen 1,118,356 boys and girls are reported as engaged in some regular occupation, but it may be presumed that few of these more than partially support themselves. This is so of those beyond the age of sixty, although 1,004,517 are assigned to regular occupations. What may be styled the productive season of life embraces the period lying between sixteen and sixty years.

Leaving out of view those who are below sixteen and above sixty, there were in the United States 27,384,446 individuals of both sexes; of these 13,907,444 were males, of whom 12,986,111 —nearly 93 per cent.—were engaged in some specified remunerative occupation. The remaining 921,333—a little more than 7 per cent.— comprise pupils in schools, students in colleges,

A LIBRARY EFFECT.

See Note 35.

the vagrant pauper, and criminal classes, and all those who are permanently precluded from labor by mental or physical infirmity. The females, between sixteen and sixty, numbered 13,477,002, of whom only 2,283,115—or 17 per cent.—are enumerated as engaged in any paying occupation.

This statement, taken by itself, would indicate that only one in six of the women of the United States, between the ages of sixteen and sixty, is occupied in any productive industry. This is by no means the case. A large proportion of them are the wives and daughters of farmers, or men engaged in other occupations, and are themselves workers, as really as their fathers, husbands, and brothers. But making all due allowance for these, the number is very large to whom directly remunerative employment is a necessity. In what directions must this employment be sought for? and how far and by what means can the comparatively small remuneration be increased?

In theory there is hardly an avocation, except, perhaps, those of law and divinity, in which a woman may not freely engage if she has the requisite physical strength; indeed there is no absolute impossibility of her practising either of these professions. In fact, there are very few avocations in which more or less women are not to be found. But the universal feeling of both sexes excludes woman to a very great extent from nearly all out-door occupations, although in most European countries she has her full share in the labors of the field. This cannot very well be otherwise, so long as huge standing armies withdraw the men in the flower of their strength from productive labor. Soldiers in camp, even in times of peace, cannot till the fields. Women must plough and dig, haul and reap, or all must starve. Few men or women of American birth or training wish things to be essentially changed in this respect, or that women as well as men should be miners, lumbermen, or out-door laborers. We now and then read of a family of women who cultivate a large farm, performing with their own hands the severest of the out-door labor. Some years ago a long, specific statement to this effect went the rounds of the newspapers and magazines. Of this we give the essential points:

"I am in the family of Malvina and Paulina Roberts, farmers, with 350 acres of good land. They have been on this farm two years. There are eight children: seven daughters and a son of nine years. This season four of the daughters, from eleven to nineteen years, assisted by their mother and a niece of seventeen, have ploughed 75 acres, dragged 100 acres three times, sowed broadcast and rolled 100 acres. More ploughing has been done, but this was exclusively the work of the mother and the five young women. The other day I saw two of the girls, aged fifteen and seventeen, sowing wheat broadcast; the oldest girl was rolling, another was dragging, and another piling and burning brush with her father. To-day the thirteen-year-old daughter was ploughing—holding the plough and driving her own team; her day's work was the usual one—an acre and a half. These daughters have the care of their own teams. One daughter, aged seventeen, is this season detailed as house-keeper, but she is as good at ploughing, sowing, dragging, and rolling as the rest of them. The house-work is by them considered the hardest and most difficult of all; they all prefer the out-door farm-work. They have now growing 45 acres of wheat, 50 of oats, 30 of flax; and are to put in 10 acres of corn, 10 of beans, 8 of carrots, 10 of potatoes, and three-fourths of an acre of onions. During the two years more than 50 acres have been cleared of bushes, stumps, and roots, mainly by the mother and daughters."

Mrs. Mary Mapes Dodge, commenting upon the foregoing, and some other like instances, says: "I allude to these facts for the purpose of resisting the one grand *clincher* generally used to strangle each new-born proposition relative to women-farmers—that they lack the requisite physique. 'Fancy a woman digging, ploughing, carting, pitching hay, and the like!' Yet, much as we may deprecate the practice, this is just what thousands of women have done and are doing the world over. Many a woman's arm, since the world began, has turned over the heavy soil and prepared it for the seed. And as for pitching hay, one of the prettiest girls I ever knew could never leave home at haying-time, because, as her father said, 'We can't spare her then nohow, for she's worth a brace of boys for raking and pitching.'" Mrs. Dodge sums up the matter in this judicious manner:

"Woman *can* do farm-work, for she has done it, and is still doing it, in nearly every part of the world. Granted that she does it at a heavy cost, for extreme physical labor is a destroyer of beauty and the finer powers of thought with either sex. Still we must remember that in most cases the alternative would not be repose, but either pinching want or uncongenial work of some kind; and there are few kinds of work which are a pastime. Woman, however, is especially adapted to the lighter branches of agriculture; and while her big brother has stronger muscles and a hardier frame than she, it is undesirable that she should devote herself to the heavy manual labor of the farm. Besides, American women (simply through generations of inactive modes of life, and not because God has made them so) are not so well fitted for severe work as most others are, though there are many who *can* do it if they *must*, or if they *wish to*, as in the case of these Roberts sisters.

"Why, then, bring in this *clincher* as the invariable answer to every query concerning woman on the farm? Does every male farmer spend his own strength in the hardest manual labor? Or does he employ stout men to pick his small fruits? Cannot women do all such work as well or better than men? Can they not, in short, take part in more than one-half of the labor of the farm—in drilling, planting, weeding, trimming, grafting, gathering, tying up bushes, training vines, and a hundred other such things? And are not these labors less exhausting and more healthful than the washing and ironing, the scrubbing and cooking, the sewing and factory-work, which so many women accept, and think themselves compelled to accept, as their appointed work in life?"

HORTICULTURE AND FLORICULTURE.—In any case the garden, the orchard, and the poultry-yard present numerous means of occupation which no one will look upon as unfitted for a woman who wishes to make money for immediate support, or as a desirable addition to otherwise inadequate means. There are, indeed, not many women in city or country to whom a few more dollars would not be very convenient. Upon the subject of profits in gardening and fruit-raising something has already been said in another chapter. From a very suggestive little work* we condense a few passages bearing upon this point:

"Women resident in the country have in many instances great advantages over those in a city, in the way of opportunities for money-making. Among these are the raising of flowers, vegetables, medicinal plants, etc., and the care of bees, poultry, and other live-stock. Many a careworn woman, struggling with her house-work, and finding it next to impossible to make both ends meet, has only to look into her garden-patch and see there the foundation of a different order of things.

"There were two sisters who found themselves sorely put to it for the means of living, in spite of owning a comfortable house and garden. A friend pointed out to them the garden as a source of revenue, and somewhat incredulously they adopted her suggestions. They hired a boy to keep the garden in

* "Money-making for Ladies." By ELLA RODMAN CHURCH.

order, to gather the vegetables daily and dispose of them in the neighboring village. It was late in the summer when the experiment was begun, and the crops had been planted without reference to anything but home consumption, but the returns were very encouraging even for that first season. In country villages the inhabitants really suffer from the want of fruit and vegetables, for which they depend on some chance huckster, or send for them to the nearest town. And yet how seldom is any one found who has the foresight to raise fruit and vegetables on purpose to supply these waiting purchasers. Even so small a patch as a half acre, if cultivated to its utmost capacity with the usual vegetables, would, with little addition of labor, not only supply the family table, but would afford a surplus for sale which would bring in a very respectable sum of money during the season."

In the neighborhood of large towns, and especially of manufacturing villages, there is nothing which is more certain of sale than ordinary garden vegetables. A family which is in possession of an acre or two of land in such a location may turn it to good account beyond the supplying of its own wants. Most of the labor of cultivating a garden is not as hard as ordinary household work, and may be performed by women as well as by men; but, in order to make this profitable, a woman requires a knowledge of market-gardening. She must know what kinds of products are wanted in her neighborhood, what kinds can be made to succeed on her plot, how to cultivate them to the best advantage, and also how to sell them. A very important item is to have a succession of crops, so that there shall be something to sell during the whole season. The gardener should not let his land lie idle, any more than the manufacturer should let his factory be closed. If a man is to succeed in any business he must understand it. It is precisely the same with a woman.

A few definite results of practical experience in any direction are worth more than much theorizing, and we condense the account which one who has made the experiment gives of her results. It will be noted that in this case there is hardly any kind of work which women are not fully capable of doing; and the result will furnish suggestions and encouragement to those who wish to learn how a little land may be cultivated for profit:

"A part of what had been a carrot-patch was devoted to onions, and all around the edge of the onion-bed I sowed parsley-seed, and between the rows of early peas were put in dwarf celery for a second crop after the first hoeing. A man worked the ground with the horses at the time of hoeing the carrot and other green crop, and made the headlands of potatoes, and we used early and late corn to prolong the season. It is astonishing how much may be produced upon a small piece of ground, if it is properly enriched, and planted wide with a view to a second crop.

"Radishes among beets are soon out of the way, and so is lettuce among carrots. Turnips did well, even late, between the rows of onions, which were pulled up in August. The turnip-fly seems to dislike the smell of onions, and left ours unmolested. Half a dozen tomato-plants, put into a warm, dry corner, not too rich, supply for first use, and a few later plants give a second crop for preserving, and these may be put in after any of the early vegetables—spinach, beets, or radishes—are pulled. The first year I grew every kind of vegetable except asparagus; since then a bed of this has been planted, and it is the most eagerly sought and highly prized of them all. Cabbage and cauliflower are grown in small quantities, the caterpillars giving much trouble, so that we had to apply air-slacked lime several times; and then, if the plants were neglected a few days, we find the leaves all riddled.

"I planted strong-rooted currants and gooseberries, in rows wide enough for the horses to cultivate. It is well to have these two near together, for the worms appear first on the gooseberries, and can be promptly disposed of by two dustings of hellebore, applied when there is dew on the bushes; they will not then appear to any great extent on the currants. Two rows of strawberries along the fence supply sufficient for table use and preserves, while by keeping a few raspberries, cut back and trained to a trellis, we have large fruit. I keep the rubbish in the compost-heap all winter, and make it the place of deposit for soapsuds and the like. When it is removed in the spring to the garden, a rich spot is left for a few melon and cucumber seeds. If these are covered with a bottomless box, having a pane of glass for the cover, the melons will ripen a week earlier than in the open air."

Such a judiciously managed garden-plot as this it is easy to see may be made a source of profit in any locality where there is a sale for its products; that is to say, in the immediate vicinity of any large village or town; and it involves nothing, except perhaps the ploughing and the manuring, which a woman might not perform. The same things are true of fruit-culture. In speaking of fruit-growing in California, we cited Mr. Nordhoff's remark that numerous German emigrants committed the care of their fruit-gardens wholly to their wives and children. There is no reason why this kind of productive industry should not be carried on all over the country, and by American women. In this, also, woman's work receives the same pay as that of man. The products of the garden or orchard bring none the less because they are raised and sold by a woman. All this implies that the working woman has the needed garden-plot at her command. Those who are not thus favored, and who must yet labor, must look out for other modes.

Domestic Service.—Of the 2,647,157 females who are enumerated in the Census Report of 1880 as having any gainful employment, 938,910 are classed as "domestic servants;" and of these about 250,000 were of foreign birth, and many others of foreign parentage. It is not necessary here to inquire into the reason of the evident fact that American women are averse to this kind of occupation. With us this domestic service ranks among the most unskilled of labor, but it undoubtedly pays better than the labor of men equally unskilled in their work. Those who engage in it have, as they suppose, no sufficient reason to learn their work properly. Very few of them expect to remain long as servants. They usually look forward to marriage, which will relieve them from the hard necessity of "living out." Domestic service with us is rarely entered upon except as a mere temporary occupation, to be given up as soon as anything better offers, although the number is large to whom nothing better ever does present itself.

Work and Wages.—The Census Report enumerates 338 different occupations practised in the United States. Women, in greater or less numbers, are engaged in 262 of these—the exceptions being usually those in which they may be presumed to be physically incapable of engaging. There are no female blacksmiths, carpenters, engineers, lumberers, masons, machinists, plumbers, or wheelwrights; no stock-drovers, sailors, or soldiers; only 2 hostlers, 2 chiropodists, 5 lawyers, 24 dentists, 67 divines, and 525 physicians. Of the 44,000 officials of government 414 were females. The problem in regard to work for women is not, therefore, to devise new occupations for them so much as to facilitate their entering largely into those in which they are already engaged; and, still more, to endeavor to secure for them adequate remuneration in these employments.

There is hardly an occupation, where both sexes are engaged, in which the earnings of women are not much less than those of men. The reason for this is that their work is usually not worth as much; and the explanation is found not in the fact that they are physically or intellectually less capable than men, but in their failure to devote themselves with equal persistence to learning how to perform the work which they undertake. The two sexes, indeed, differ in many respects, physically and mentally; but leaving out of view those employments in which great physical exertion is required, the natural advantages about equally balance each other.

A young man looks upon the occupation in which he is about to engage as the one which will most likely be the business of his life. He has, therefore, every incentive to make himself master of it, for in that mastery lies mainly his prospect of ultimate success. He knows, moreover, that the family which he will in time come to have around him will depend upon his exertions. From the very first he looks upon his trade or profession as a permanent one. He learns telegraphy, let us say, and expects to be a telegrapher, and means to be a thoroughly competent one. The young woman who learns the same business comes to it with very different purposes. In the great majority of cases she naturally and properly anticipates that she will be a wife before many years or, perhaps, months have passed. This anticipation gives form and color to the whole of her life as a workwoman. This subject can be best studied in those occupations in which both sexes are employed in the same kind of work.

Silver-working.—A large silverware manufactory in New York employs many hands, among whom are twenty-five women, who earn from four to twelve dollars a week. The result of their experience with workers of both sexes is suggestive. They say:

"Young women who have secured positions in the factory are, as a rule, loath to make haste slowly. Their brothers enter at sixteen, and obtain men's wages only after an apprenticeship of five years, meanwhile receiving four dollars a week and upward. They understand perfectly that any real advance in acquiring a knowledge of the silversmith's art, and proficiency in the use of it, must be made gradually, and step by step. They have been taught so by their parents, by their associates, and by their own observation, and they act accordingly. But the girl who goes to work there has an extra purpose of her own. She wishes to get over the preparatory ground as rapidly as possible, and to earn full wages in half the time that her brothers do. She has not learned that in such a business she must make haste slowly if she is to make speed at all.

"In the next place—not always, but frequently—she becomes restive under authority, and occasionally refuses to do the work laid out for her. 'This piece of silver,' said a girl to the foreman, 'is too thick for me to saw: it is men's work.' The foreman will tell you that when he is pleasant to a girl under him she is apt to try to ride over him. Any boy or young man in a similar position would expect to be discharged at once if he hesitated to obey the foreman, or suggested that somebody else could do better what had been asked of him. A young woman, on the contrary, is found to be more or less disputatious in tendency—to argue a matter where every law and precedent of business life requires prompt obedience to the orders of the foreman.

"Nor is it easy, when the foreman insists upon having his orders obeyed, for her to believe that he is strictly impartial. 'You don't like women, Mr. A——,' said a young woman, in answer to the repetition of a request from the foreman that she should do something distasteful to her. And if, on the other hand, the foreman seems unusually complacent, his demeanor is apt to be ascribed to his own good-nature, without reference to her own merits or demerits. The other day a young woman said of her foreman to a fellow-worker: 'Mr. B—— has a noble heart.' 'Better not trust to that,' was the reply; 'he will discharge you in a minute if he thinks you deserve it.' The inability to appreciate the significance of the phrase, 'Business is business,' lies at the root of such shortcomings on the part of young women.

"Then again, the young woman who is learning the silversmith's art has been found to lack self-confidence. 'Well, if you think I can do it,' she is apt to reply, when asked to do something new to her. 'Don't be timid,' replies the foreman; 'if you get it wrong, try again.' The prospect of learning a new branch of the trade usually disheartens her. She will go a certain distance very well, but she will not learn the one thing extra, the knowledge of which would give her the rank and the pay of a skilled workman. Etching on silver is to-day more fashionable than engraving on silver; but if the case were to be reversed, and engraving should again come to the front, the foreman would expect the average girl to be unwilling to learn engraving if she had already learned etching. 'One trade is enough for me,' he would expect to hear her say.

"Then, moreover, there is the old obstacle of marriage. You train a girl to be an expert in the business, and all your time and labor go for nothing the moment she gets married. We have here scores of boys who wish to stay for life,

EMBROIDERED SCREEN.

See Note 36.

because they know that we can make it for their advantage to do so. Everything we teach them is a permanent help to us; their services become more and more valuable, and are always at hand. But as soon as one of our girls is married that is the end of her, as far as we are concerned, and what encouragement is there in training a girl when she may leave you at any moment?"

To the question, if there was any reason why girls should not resume work in this establishment after marriage, the reply was, "None whatever. We should be glad to have them come back, but they never do; they are too proud." This pride is in itself a very proper one, and is fully shared by their husbands. Both feel that they have married for a home, and, at the very best, much that constitutes a home is lost if the wife must be absent from it during the day. The objection on either side is not that the wife should work, and work for pay, if she can do this at home. Upon one occasion the foreman of such an establishment was asked by a workman to let him take home work to be done by his wife, who had left upon her marriage. "We cannot do that," was the reply, "but if your wife will return to her old place we will find work for her." The well-meant offer was not accepted.

In the establishment of which we are speaking women are paid the same prices as men, for the same work. That the best female workers do not receive as much as the best males is simply because they do not earn it. For reasons such as have been adduced they have not qualified themselves for doing the work which requires the most skill, and which consequently is most highly paid. But these objections do not apply to every young woman, and not, to a very serious degree, to the majority of those employed by this establishment, for the proprietors propose not only to continue to employ women, but to increase their number very largely, not out of charity, but simply because, upon the whole, they find it for their interest to do so. The disadvantages arising from the employment of women in their business are counterbalanced by such advantages as the following:

"Girls are regularly at their places on Monday morning, while men are not always so. Moreover—and this is a matter which is coming to be regarded as of no little import—women are not often members of trades-unions, by which they may be ordered to 'strike' at any moment, whether they like it or not. Thus, in two ways, and to a certain extent, they are more reliable than men. Then again there are certain departments in this art, as in several others, in which the thinner skin and more delicate nervous system of women are thought to give them a natural capability superior to that of men."

We have spoken at length of the silversmith's art as applicable to women, for it is one in which the experiment may be considered as having been fairly tried. It requires nothing for which the physical powers of women are not fully adequate. The departments in which it has been found that women work to as much advantage as men are thus stated by the able writer,* from whom the foregoing statement has been condensed: 1. General finishing, including burnishing. 2. Preparation for gilding, for enamelling, and for etching. 3. Engraving. 4. Chasing, or *repoussé* work. This last consists in the indenting or modelling of the surface, the parts of the metal not being cut away, as in engraving. The writer adds:

"All this work requires the exercise of artistic taste to a greater or less extent, and if we add to it the higher business of designing, in which women have already accomplished excellent results, we shall obtain a just conception of the nature of woman's work as a silversmith. Any woman possessing ability as a designer can earn from twenty to sixty dollars a week, and there is no reason why she should not fit herself for that specialty. But to become a silversmith a woman must be willing to enter a workshop, to obey rules that sometimes seem harsh, and to be dead in earnest."

Art-work.—In work in which the artistic faculty is brought into play, and just in proportion as this is the case, women are growing into an equality with men in the matter of remuneration; but here we meet the same difficulties which have been mentioned in the case of silversmithing: they are too much in haste; they wish to reap the harvest as soon as the seed has been sown. Take a single example: Some two years ago the Metropolitan Museum of New York opened a class for instruction in decorative art, the object being "to furnish instruction to young women seeking a means of support in practical, remuner-

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* In *Harper's Bazar*, August 18, 1883.

ative production." A considerable number of pupils presented themselves the first year. The second year the attendance was much less. One of the directors of the Museum thus accounted for the notable falling off in the number of pupils:

> "The whole trouble is this: the young women who entered the class were in too great a hurry to make money; they expected to be coached at once into a state of affluent remuneration. Anybody can easily learn a smattering of anything, but there is no royal road to thorough knowledge. In order to design well, a protracted drill in elementary principles—particularly in drawing—is indispensable. As soon as we began to teach them drawing they were impatient to get into coloring. As soon as we began to show them *how* to make money, they were so eager to be making it as to spurn the necessary prerequisites thereto. This has been our difficulty, and it is one that cannot be overcome until young women who aspire to support themselves by art consent to make themselves, at least, respectable draughtsmen."

Nevertheless there are not wanting young women who have the good-sense to perceive the openings which present themselves in this direction and the resolution to put forth the preliminary effort requisite for success. We collate from various authentic sources instances and hints of what has been done by a few persons within less than two years, as furnishing an indication of what may be done by others:

A young woman who has mastered the fundamental principles of design, and who is able to impress *herself* upon her work, has several ways for disposing of the products of her skill:

1. She may become a teacher. In 1882 we are told that at the Cooper Institute "the demand from the West for teachers of drawing is greater than ever before; and clever girls who are recommended by the authorities of the Institute find no difficulty in obtaining remunerative positions. One of these girls is now a teacher in Michigan, at a salary of eighty dollars a month; another receives a thousand dollars a year. In the Eastern cities and their suburbs from one dollar to two dollars an hour is paid for such instruction by principals of schools or private persons. But it must be borne in mind that in order to become a successful teacher one must have already been a diligent and apt pupil."

2. Some of the leading firms of house-decorators now employ

women to carry out their designs, at a salary of from eight to twelve dollars a week. "This work pays less than much special work performed by the artist at her own home, but it affords her a means of familiarizing herself with the best which is doing in her department, increases her acquaintance with the current modes of business, and gives her many facilities of creating a constituency of her own—provided always that she possesses the requisite capacities, and has learned the meaning of the phrase, 'Business is business.'"

3. She may make designs at home, and sell them directly. The demand for such designs is much more widely extended than one not acquainted with the subject would suppose. A really artistic design for a dealer's "trade-mark" has no little to do in selling the article. A gentleman's hat, with a pretty stamp on the lining of the crown, will sell more readily than it would without it. A box of confectionery, of gloves, or any one of a hundred fancy articles, is much more attractive to purchasers if it bears a tasteful label. Not a little genuine artistic skill is now put forth on the business cards of tradesmen. Clever dealers have discovered that such a card is preserved and looked at by a score of persons, when an ordinary one would be thrown aside at once. An appropriate artistic design for the cover of a book does no little towards increasing its sale. A cleverly designed placard induces many purchasers to enter a shop which they would otherwise pass by. Tradesmen and manufacturers of all kinds are becoming aware of this, and act accordingly. At first they contented themselves with borrowing the designs of foreigners; but they have more than begun to discover that there is such a thing as an American public desirous of having original designs and patterns such as shall express American ideas and feelings, and bring out the aroma of the soil upon which Americans live.

ENGRAVING.—Wood-engraving has been mentioned in another place as among the arts which afford a high scope for the labor of women. Ten years ago we doubt if there was in the United States a single woman who had even begun fairly to look to this profession. If there were any female engravers in

1880, the enumerators of the Census failed to discover the fact. Now the number is quite noticeable who have already passed the threshold, and there are at least half a dozen who may be fairly ranked among the members of the school of American engravers, confessedly the best in the world. Among the scores who are aiming in the same direction it may fairly be expected that there are others who will come to stand by their side. We are told that "the most successful of the women engravers who have fought their way into the front ranks of the men engravers has taken eight years in accomplishing the feat, but already she is offered more orders than she can execute, and some of her best work has paid her at the rate of sixty dollars a week." A man or woman who attains the capacity of producing the best class of work in eight years of diligent labor and study does well.

But he or she has this advantage over the members of most professions: the work is of such a nature that it speaks for itself, and needs no great previous reputation to secure recognition from the publishers and editors who are the main customers. And, moreover, there are opportunities for earning respectable sums while actually learning. The statement was authoritatively made in 1882 that "in one of the classes of the Cooper Institute are two clever girls who, in the second year of their training, made six hundred dollars apiece by executing orders for publishers; and last year there were twelve pupils who earned a hundred dollars apiece in the same way in twelve weeks — a sum more than sufficient to meet their necessary expenses during that term; this money was received for work in the profession which they were studying. They were fitting themselves to get better prices by earning the money which they did get."

There is for women a special advantage in this work above that of the silversmith. It is not necessary that the work should be done in a factory or workshop, but may just as well be carried on at home. The accomplished woman engraver who marries is not thereby precluded from gainful employment any more than is the female author. If her household duties are such as to leave her the time, she can devote it to the practice of her profession as a regular employment.

Other Spheres for Women Artists.—The sphere which decorative art already opens for woman's work is continually widening. Many things have contributed to this, but nothing else so much as the far-sighted benevolence of Peter Cooper. If we were called upon to name the noblest feature of that monument which he has erected for himself, we should select the "Free Art School for Women"—a department of the Cooper Institute. Not long before his death, in April, 1883, we read that at the previous session of the school 1397 pupils applied for admission, but only 711 obtained it, on account of lack of room. One of the teachers, herself a woman, said that during the previous year forty of her pupils in art had made $7000, or $175 each, while learning the art of crayon-photography. "Every year one hundred young women, on leaving the Cooper Institute, make from $400 to $1200 a year by art-work, the largest demand being for teachers of drawing and for makers of crayon-photographs. One graduate is now receiving from $2000 to $3000 a year as a teacher of drawing in the New York public schools, and another has been appointed manager of a decorative art society in New Orleans, with a salary of $150 a month, with opportunities to earn as much more by private tuition; and similar instances are numerous." The writer of the foregoing goes on to say:

> "A little girl, as Mr. Cooper described her to me, called at his house to thank him for what she had learned at the Institute. 'I have earned $300 this year,' she exclaimed, with enthusiasm, 'by painting photographs, and anything else I could get hold of.' A man in middle life met Mr. Cooper on the stairs of the Institute. 'My daughter,' he said, 'makes $1300 a year by teaching painting and drawing in a Brooklyn school, and I never earned more than $1200 a year myself.' A young woman from California sat on the sofa in Mr. Cooper's library. 'I have come to thank you,' she said. 'I feel as rich as a queen. I have thirty pupils in wood-engraving.' Like her two sisters just mentioned, she had studied art at the Cooper Institute."

The coloring of photographs gives employment to many hundreds of young women, and there is no prospect that the market will become glutted. In 1882 there were thirty of these young workers in the school of the Cooper Institute, one coloring a portrait, another a landscape, a third an interior, and so on. About one-fifth of this number were earning from five to twelve dollars a week by executing orders, and this while they were learning their art. After a two-years' course of study many of them will make more, and sometimes even during the first year they earn as much. But let no one imagine that facility or even capability in this art is to be acquired without a natural artistic faculty, and granting this, not without labor and thought. Each art has demands of its own. This one demands not only an eye for colors and dexterity in using them, but also a knowledge of drawing.

Painting on china is another of the ornamental arts in which women may to a certain extent find remunerative employment. The subject of decorated pottery has been considered in a previous chapter. Here it may be added that the general principles of art having been mastered, their special application for this purpose is easily learned. Four years ago it was assumed that the passion for decorated china was merely a "craze," which would soon die out, but there is no present indication of this, the shelves of the crockery-dealers are full of painted china, and the Society for Decorative Art finds sale for more of it than for any other production except embroidery.

Embroidery is especially woman's work, but like all other needlework it is very poorly paid. Large quantities of it do, indeed, find purchasers, but those who have the best opportunities for making an estimate say that a skilful embroiderer who can earn two dollars a day in this occupation, so wearying to the back and eye, is fortunate far beyond the average. Small articles for common use pay better than larger ones. It was thought to be a great thing, not long since, when a piece of elaborate embroidery was sold for $125, but it had cost just that number of days to do the work. It must be set down as one of those very pretty arts which a lady may practise at odd hours for her own adornment, or for making acceptable presents to her friends, and if she occasionally receives a few dollars for an order from the Decorative Art Society, or otherwise, that is so much clear gain.

WOMEN AS ARTISTS.—Mrs. Susan N. Carter, the accomplished principal of Cooper Union School of Art, presents, under the title, "Women who should not Study Art for a Living," * some suggestions well worthy of consideration in connection with what has been stated in the preceding paragraphs. She says:

"It is a curious and interesting study to look over the multitude of drawings which are sent each season for inspection to a school like this. The pictures are supposed to prove the talent of their authors, who hope, after a few months' study, to earn a good living by art. Some of the drawings are good, and occasionally a really beautiful specimen of flower-painting, pen-and-ink work, or little landscape is sent. But most frequently these works are rude copies of bad originals, and really indicate nothing, as a general thing. The girl may have talent, and she may not. All that can be known is that she wishes to make out a living and a profession. If she truly wishes to succeed what must she do?

"In music it is very obvious that the fingers can only gain strength and nimbleness by constant practice, and in art it is equally true that the eye and the judgment can be trained only by long and constant effort. A few hours in the week may make a pleasant amateur artist, but the work which can rank as professional, and which will insure pecuniary reward, has to be pursued through long, steady interest and application.

"It is true that often, after a few months' teaching, young women can earn money by finishing photographs, but those who do this have talent for likenesses and a clear eye to preserve the look of the portrait, for a careless touch or blunt perception may in a moment efface the line which makes a nostril or the curve of a lip true. And if the artist has not the knowledge of form to appreciate how the picture should look when finished, it will quit her hands a stupid and ignorant result. Photograph work requires patience, neatness, talent for observing and producing form—or, at least, not losing it—and long application. The young artist must have mastered the details of form, use of material, ideas of style, until she knows a great deal about drawing, and then only can she succeed.

"Engraving, much more than photography, requires continuous study. A woman with deft fingers, a quick eye, and intelligence, united to a sense of the picturesque, may, indeed, be able to earn money from the work she can do in simple line-engraving if she study six hours a day during that time; but unless she is willing to give at least three years to her education she had better not adopt this profession. In drawing, also, and learning to design, character and

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* In *Harper's Bazar*, February 3, 1883.

SPRINGTIME.

See Note 37.

disciplined powers are as important as talent; and though in teaching several thousands of women to draw during the past ten years I have never had an example of success unless aptitude was shown soon after the beginning of study, yet beauty, comeliness of form, rendering of light and shade, and the numberless points which make the charm and value of a good drawing, come only from the continuous habit of study, which carries the thought of one day into the work of the next, and so accumulates and develops artistic impressions.

"Brilliant examples of success have led many young women to seek admission into art-schools who have not the proper qualifications. A large class of those who plan and work to enter the school have no clear idea of what will make their lives a failure or a success. All the qualities I have named are *necessary*, and unless a young woman is possessed of them her labor is in vain. If they have the necessary talent, and love art enough to make the sacrifices required for success, let them venture, but none should attempt art merely because they desire to get a living. They had better try something for which they have an aptitude, or at least some occupation which does not require all these essential qualifications which I have mentioned.

"There is one point about which many women think vaguely: What necessary connection is there between marriage and art-employment? Long observation of multitudes of women is convincing that though many give up such work when they marry, yet, if they have really studied it to the point of success, they can use their whole time, or even odd time, in doing work which will pay well. They have *really* learned a profession, and whether it is simple or elaborate work, with a little continued practice they can still earn money after their steady and continuous school study has ceased."

CHAPTER XL.

WORK FOR WOMEN—*Continued.*

CLERKSHIPS of various kinds are among the branches of industry which occupy women. The number who are thus engaged is quite considerable, but the Census Report is not sufficiently definite to be of much value in this respect. The cases are exceptional in which book-keepers receive more than two-thirds as much as men who perform similar duties, and the instances are exceedingly rare in which female book-keepers are employed in situations which among men command high salaries. Very many are engaged as saleswomen. The number of young women in this vocation, and even of girls below the age of sixteen, is inordinately large. The duties are very exhausting, and are protracted more than in almost any other occupation; for, as a rule, stores are kept open to a later hour than workshops. In many ways, at which it is not necessary to more than hint, a shop-girl is exposed to peculiar temptations, especially where men constitute the customers whom she has to serve.

TELEGRAPHY presents many apparent advantages for women. It does not involve the soiling of dresses, the operators do not stand, they need not sit in a constrained posture, and the work does not involve great muscular exertion; yet there is certainly a severe strain upon the nervous system, and as they are more delicately organized than men, they are less adapted to the most efficient protracted telegraphic labor. The experiment has been pretty fairly tried by the great telegraphic corporations, bodies which can be moved only by pecuniary considerations, and the result seems beyond dispute: women, as a rule, are not as efficient as men. The poorest of the one sex are probably no worse than the poorest of the other, but the average of the females of the same experience is below the average of the males, and the very best female operators are not above the average of the males. Taking all things into account, it may be fairly concluded that telegraphy presents, for women, just about the same inducements as does the profession of teaching in the public schools of our cities and large towns, with this difference: that teaching offers some positions which pay much better.

Type-writing is an occupation which has sprung into existence within less than ten years, and is especially adapted to women, requiring in the main physical and mental qualities in which she excels man—such as quickness of apprehension and delicacy of touch. The operator frequently performs the functions of a private secretary and amanuensis, and is rapidly taking the place of the copyist in law-offices and counting-rooms. Her efficiency, and, consequently, her remuneration, may be greatly enhanced by a knowledge of some other matters. Phonography is an adjunct of very decided advantage, for she will not unfrequently be called upon to write from dictation. She need not be so rapid a phonographer as to be able to follow unerringly a fluent public speaker: half or a third of that rate will answer every usual purpose. The person who is dictating rarely talks at full speed, and will make the requisite pauses, or repeat anything that has not been perfectly understood. A fair preliminary education, equivalent at least to that imparted in our best public schools, is an essential prerequisite. She will, moreover, be obliged to write down from dictation many words not used in common conversation. These will vary with the nature of the business of her employer. If he is a lawyer, there will be one set of technical words; if a merchant, another set, and so on. She should understand the meaning of these when she hears them, and know how they are to be spelled. Defective orthography is an almost insuperable bar to success. An acquaintance with some foreign languages, especially French and German, is a very decided advantage. This occupation is very rapidly extending, and it is universally conceded that young women make better operators than young men. The average earnings are estimated at $500 a year: a few receive twice as much. The work in itself is among the most pleasant of all employments, being almost the same as piano-playing, only with a key-board of half the size. The hours are usually considerably less than in most other employments, being those of the business-man rather than of the workman.

TYPE-SETTING.—Closely allied to type-writing is type-setting. Some of the large publishing-houses have separate composing-rooms for men and women, although in the latter, as will be seen, it is necessary to employ men to do certain portions of the work. From the foreman of one of the best organized of these offices we gather the following particulars: There are in his room about fifteen female compositors, and as many men and boys. The girls have been mostly trained in the office. It is preferred that one should be about fifteen when she begins. She works two months without pay, for it costs more to teach her the elements than her work is worth. If she has made fair progress, at the close of the two months she is paid by the piece, at full woman's rates, the amount of her earnings depending wholly upon the quantity of work which she accomplishes. It will not be very long before the average female compositor will earn $4 per week, gradually increasing as she becomes more expert. At the end of a year or so she will earn on an average $7 a week. She is not tied very closely to a given number of hours a day. As a rule, she is engaged about eight and a half hours, although she may, if she choose, work ten hours, as the men and boys usually do; in which case, as she works by the piece, her earnings would be so much more. That she labors shorter hours is not to be attributed to indolence, for there are many things which a woman attends to for herself which a man cannot well do: such as repairing her own dresses, and even making them, to a greater or less extent. The present rate here for ordinary plain work (upon which they are mainly employed) is 35 cents per 1000 ems. The men receive 38 cents, but they do several things in connection with their work which the foreman or his assistants do for the women; so that, practically, the pay of the two sexes is equal for the same work.

The experience of the establishment for several years is to this general purport: the directions in which female labor can be advantageously employed are somewhat limited. In "plain work," that is, where an ordinary book—say a novel, or the usual pages of a volume like this—is to be set up from printed copy, or from manuscript properly prepared for the printer, there is no very great difference between men and women, whatever advantage there is being, however, in favor of the former, for the "proofs" of the men are, as a rule, more free from errors than those of the women, and therefore demand less labor on the part of the proof-reader; but in the more intricate kinds of work, such as the tables in this volume, women are very decidedly inferior to men. The man will usually study out for himself how a difficult piece of work should be done; the woman would expect that the foreman should explain it to her. As the foreman phrased it: "My girls don't like conjuring up how to do anything; they do not put so much brains into their work as the boys do." Probably there is not a single female compositor in New York who could advantageously, either to herself or to the office, be set to do any of the table-work in this volume.

In the office of which we are speaking only very neat work is allowed to pass. For example, the matter must be uniformly "spaced;" that is, not only must an equal space be left between the words in each line, but the spacing in the different lines must be as nearly as possible uniform. There must not be some lines very thinly spaced and others very widely spaced. There are offices in which women are largely employed at prices very much below those which we have given, and where neatness of execution is not insisted upon. Women trained in such offices have sometimes found employment in the one of which we are speaking, but the experience of the foreman has been that it is much harder to make them unlearn bad workmanship than to teach fresh hands to do good work from the first. Men are much more readily raised to a higher degree of skill.

There are few employments in which a young woman can begin to earn wages so quickly after beginning as in this, and the sum which she can expect to earn is decidedly above the wages paid to operatives in factories or upon sewing-machines, and is quite as pleasant and healthy.

THE CIVIL SERVICE of the United States Government certainly affords opportunities for the employment of many women, and should probably afford more. In theory the law, as it stands, renders "nominations to clerkships open to women as well as to men." But practically, according to the rules, although the number of nominations may be ever so large, the number of actual appointments of females must, in any case, be comparatively small. The posts attainable by women may be arranged in three classes: 1. Certain designated positions in the various departments at Washington. Practically these are in the Treasury Department, where it is said that in counting money women excel men. 2. Appointments in the postal service; but these positions occur only in post-offices where the whole number of officials is not less than fifty. Of these offices there are at present only twenty-three, in the following cities: Albany, Baltimore, Boston, Brooklyn, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Indianapolis, Kansas City, Louisville, Milwaukee, Newark, New Orleans, New York, Philadelphia, Pittsburg, Providence, Rochester, St. Louis, San Francisco, and Washington. 3. In Custom-houses in which the whole number of officials is not less than fifty. Such offices are at present in the following eleven cities: Baltimore, Boston, Burlington (Vt.), Chicago, Detroit, New Orleans, New York, Philadelphia, Port Huron, Portland, and San Francisco. The larger number of clerkships are in the first of these divisions.

As there is every probability that the "classified civil service" will hereafter embrace many more females that it has heretofore done, it is desirable that the prescribed mode of procedure should be generally known. There is a regular form for an "application paper," which can be obtained either from the office of the Civil Service Commission at Washington, or from the post-office or custom-house of either of the cities above-mentioned. This application, which must contain the names of five persons as vouchers for the good character of the applicant, must be forwarded to the Commission at Washington, if it is for a position in one of the departments, or, if in the postal or revenue service, to the postmaster or head of the custom-house of the district in which service is desired. The party does not apply directly for an appointment, but for admission to an "open, competitive examination as to fitness for the public service;" and when a vacancy occurs it is to be filled by selection, according to grade, from among those graded highest as the result of such competitive examination; "but the number of appointments must be apportioned among the several States and Territories, upon the basis of their respective population." The names of the applicants are entered upon a register, but no person can remain eligible more than one year upon any register.

The examination takes place at such time and place as is designated by the proper authorities. It consists mainly of written answers to written questions upon the following subjects: 1. Orthography, penmanship, and copying. 2. Arithmetic. 3. Interest, discount, and the elements of book-keeping. 4. Elements of the English language, letter-writing, and the proper construction of sentences. 5. Elements of the geography, history, and government of the United States. Proficiency in these subjects will be credited, in the grading of the candidates, "in proportion to the value of a knowledge of such subjects in the branch or part of the service which the applicant seeks to enter;" but in the first, second, and third of the above divisions the applicant, in order to receive a certificate, must receive at least 65 per cent. of "complete proficiency"—that is, nearly two-thirds of the questions must be answered correctly.

When a vacancy occurs in any of these branches, the officer who has the power of appointment applies to the board of examiners for four names from those standing highest on the proper register, and the law provides that "sex shall be disregarded in such certification, unless there be a law or regulation which calls for those of either sex, in which case the four highest of that sex shall be certified." Practically, therefore, one of the four persons, irrespective of sex, who are graded highest, must receive the appointment, and if any one is higher than all the rest, it may be assumed that he or she will be the successful candidate. If two or more receive the same grade, the selection between them will devolve upon the head of the department in question. The appointee remains upon "probation" for six months, when, if competency is evinced, the appointment is finally confirmed, and the incumbent cannot be removed except for cause duly proven. It will be seen that in respect to these appointments there is no distinction of sex. The salaries of each position are definitely fixed by law, altogether irrespective of the sex of the appointee; and though none of the salaries are very large, they are yet sufficient to make these positions apparently very desirable for women. The highest salary, we believe, attached to any of these clerkships is $1500 per year.

This system of rendering certain positions in the Government service non-political is an experiment among us, but it has been tried in Great Britain to some extent for a long time, in respect to both sexes, and the results are universally conceded to be eminently satisfactory. If the positions of which we speak were subject to what has been our baneful custom, by which it is held that the "patronage" of offices belongs to the politicians who happen to be in power, and that the bestowal of them is to be a reward for services rendered to "the party" by friends of the applicants, we should certainly do all in our power to dissuade women from seeking such employment. But if the aims which the Civil Service Commission professes to have in view shall be fairly realized, we consider that this occupation is one altogether womanly, and the principle embodied in it might be extended to many more positions in State and municipal governments.

There are, indeed, numerous positions in the public service from which women are naturally excluded by reason of their sex. No one would advocate that a woman should be President of the United States or Governor of a State, Secretary of War or of the Navy, a General in the Army or Admiral in the Navy,

SOME ART CONNOISSEURS.

See Note 38.

Collector of a Port or Chief of Police. But excluding all of those clearly unadvisable positions, there still remain many which should be open to women, provided they are qualified to fill them. The thing upon which those who favor this view urgently insist is that women shall have fair opportunity to show whether they do or do not possess this fitness. "The tools to those who can use them," it is urged, is the true maxim to be applied here as elsewhere. The "Civil Service" law is intended to promote this end, which all admit to be in every way desirable, and, it is hoped, not wholly unattainable.

It may be assumed that however widely the doors to the Bar may be opened, there will never be among us many female lawyers, and probably only a few preachers. How far the proportion of female physicians may properly extend is yet a matter of discussion, into which it is not proposed here to enter. It is sufficient to say that there has been a steady, if not a rapid, increase in the number of females who fit themselves for the medical profession. The requisites for the successful exercise of these professions are essentially the same for women as for men.

Teaching is fully recognized as a feminine not less than a masculine profession, and the normal schools for the training of competent teachers of both sexes are among the most useful of our educational institutions. In the matter of remuneration there is certainly a tendency in the right direction. As women become more and more fitted for this profession, their salaries approximate more and more to those of men; but in both, as has already been insisted upon, the salaries are wholly too low for the duties which a competent teacher has to perform. In the higher grades of our public schools the inequality of salaries paid to the sexes should be done away with. The duties imposed upon the principal of a female grammar-school in the city of New York are in no respect less than those of the principal of a male school. If a woman cannot perform them as well as a man, this is a good reason why she should not fill such a situation. Here the saving of a few dollars a year, by getting inferior service, is the most foolish of all unwise economy. If there be, as undoubtedly there are, departments of instruction which men only can fill in the best manner, let them be reserved for men; but no teacher should be called to a place in our public schools for which he or she is not fairly competent. The value of the services required should be the measure of the remuneration, and this value is nowise affected by the sex of the teacher.

The disproportion between the salaries paid to male and female teachers, where equal competency may be assumed, is fairly shown in the grammar-schools in the city of New York. In these, in 1882, there were 23,102 male pupils and 726 male teachers, with an average of 31.7 boys to one teacher. There were 19,844 female pupils and 607 female teachers—an average of 32.7 girls to one teacher. The average salary of all male teachers is $1112; the average salary of all female teachers, $826. The salary of the male principal of a school, with an average attendance of more than 500 pupils, is $3000; that of the female principal of such a school, $1700. The salary of the male vice-principal of a school having more than 250 pupils is $2000; that of the female vice-principal, $1200. The average salary of male assistant teachers is $1500; of female assistants, $800. There is, moreover, a special provision that the Board of Education *may* pay to all male principals of more than fourteen years' service a salary of not less than $2500, and to all such female principals not less than $1900, irrespective of the number of pupils in their schools. Thus the highest possible salary of a male principal is $3000, and the highest possible salary of a female principal is $1900. A similar discrimination against women pervades the whole system. Thus there is a grade of junior teachers whose salaries for the first year are $700 for males and $400 for females.

In Literature and Art there is no such discrimination against woman. She receives just as much as a man does for a story or an essay, for a novel or a history, for painting a picture or singing a song. If any one gets more than another, it is because the work is worth more. At present fully one-half of the popular novels, poems, and magazine sketches are written by women. Women here are as successful as men, just because their work is as good. The public and the publishers care nothing for the sex of an author.

Nursing.—However wide may be the divergence of sentiment upon other points, no one questions that the care of the sick is pre-eminently woman's work. It is one which has always devolved upon her, and it seems almost to be assumed that proficiency in it comes to her by instinct, without need of careful and well directed training. It may be admitted that many women — perhaps most — are, to a certain extent, natural nurses. There are few women who will not be called upon at one time or another to act as such in their own families, and all should learn what is to be done in common cases of indisposition, and even in graver emergencies, when the attendance of a competent physician cannot at once be had. There are, moreover, everywhere women who have somehow gained the reputation of being skilful nurses, and they are not unfrequently called upon by their neighbors to advise what should be done; but the ideas which such persons have acquired are often misleading: they are apt to advise in all cases something which they suppose has proved beneficial in some other instance. If it so happen that several such persons give their advice in any one case, they will differ very greatly, the patient or his friends not seldom undertaking to follow all the recommendations, and serious results often ensue from this ill-advised overnursing or overdosing, even when the advice of any one of them might have been properly followed until better could be had. The importance of this household nursing can hardly be overrated. It is proposed here, however, to speak of nursing as a profession, to be studied as such, with the purpose of making it a remunerative occupation for those who may be led in that direction by circumstances or inclination.

If there be one thing for which it is wise to provide beforehand, it is for proper care during sickness, which may come to all and will surely come to most. It is much to have a competent physician, but this is by no means all. A physician with a large practice can devote only a comparatively small portion of his time to any one patient, no matter how critical the case may be, for there will be others with equal claims upon his care. He can rarely spend consecutive hours by the sick-bed, watching each change of the disease, and personally seeing to it that his directions are followed to the letter. When he makes his regular visit he needs to know not merely what is the present apparent condition of his patient, but also what fluctuations have taken place since his last diagnosis. He can, indeed, infer much from what he sees at the time, but upon some points he must depend upon the information of others. Few patients are in a state to describe accurately their own condition, and the friends in attendance are usually equally incapable.

That the physician should act with perfect confidence in a critical case, it is essential that he should be assured that the patient is under the care of a person who will not only obey his orders, but can inform him what has been the effect of his mode of treatment. The province of the nurse is not in the least to supersede the functions of the physician, but to aid him in carrying them out. The wiser a physician is, the more fully will he recognize the value of a competent nurse; and if, as is always desirable, she be selected by him, so much the greater will be the hopefulness with which he meets the responsibilities of his position. These are heavy enough at the lightest, how great soever may be the aid which he may be able to secure from the nurse or friends. Indeed, there are reasons which render it often desirable that the nurse should not be a near connection of the patient. Physicians are usually unwilling to treat a critical case in their own families, for they are aware that their anxiety tends to impair the soundness of their judgment.

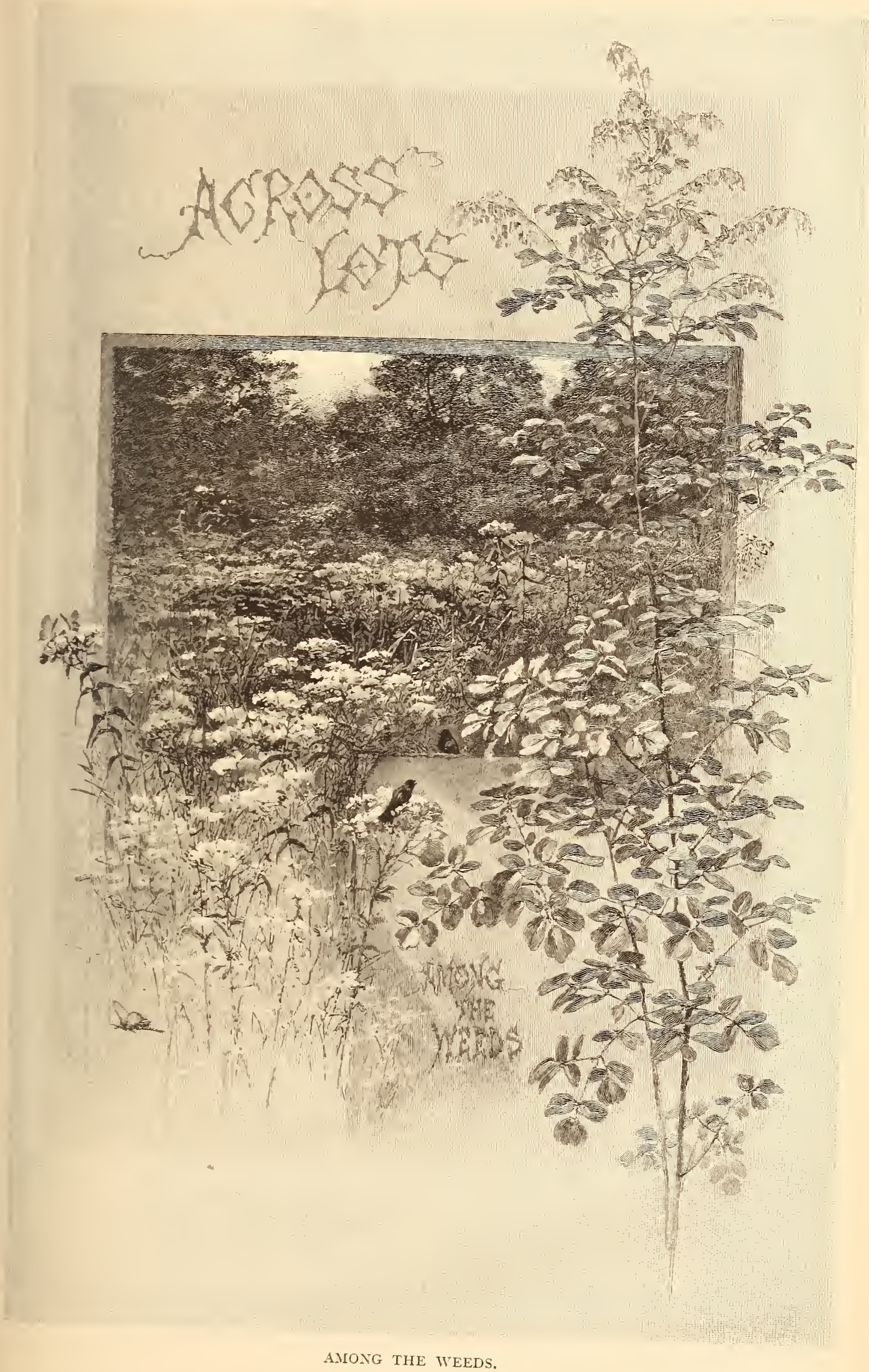
This is not less true of the nurse. It is not easy for a wife or daughter to compel a husband or father, whose authority has always been unquestioned, to do, or suffer to be done, anything to which, in his morbid condition, he is averse. A mother or sister is under strong temptation to humor a sick child, although she is perfectly aware that it may be to its injury. The professional nurse should be as free from all this as the physician. She should feel, and make others feel, that, in the absence of the medical attendant, and subject to his orders, the patient is under her sole charge, and that no one must interfere with her. When a physician finds that his directions are systematically disregarded he throws up the case; the nurse should do the same.

Except in rare cases, there has been until recently no means of securing the services of a competent professional nurse—in fact, there was, strictly, no such thing—and not a year ago an able writer speaks of nursing as "a new profession for women." The first schools for the practical training of nurses in Great Britain originated with the efforts of Florence Nightingale, some thirty years ago. The first successful attempt in this country was made as late as 1873, by the founding of the Training-school for Nurses in connection with the Bellevue Hospital in New York. The plan was developed in accordance with that elaborated by Miss Nightingale. The requisites demanded of the applicant for admission included a fair education, healthy constitution, and freedom from personal defects, especially those of sight and hearing. The course of instruction was to last two years; it comprised training in dressing wounds, applying fomentations, preparing and applying bandages, rollers, and splints—cooking, especially the preparation of delicacies for the sick. Instruction was also given as to the best methods of warming and ventilating the sick-room, and for promptly meeting the thousand emergencies which are liable to occur.

The experience of the first year was not encouraging. Applications for admission were presented from two-thirds of the States of the Union, but of the 79 applicants only 29 had the preliminary qualifications, and of these 10 were dismissed within nine months. The managers wisely, however, resolved not to lower the standard of requirements or the thoroughness of training, and they soon found that the fitness of an applicant for the work could be determined only by absolute trial, for many who at first manifested no special aptitude for the work proved in the end to be the most efficient. Some of the students in this school have taken upon themselves this life from motives of pure benevolence, meaning to devote themselves to the care of the sick poor, but most of them study this new profession with a view to gaining a livelihood, and all receive the same general course of instruction.

All the students are boarded and lodged by the school, which has a "home" near the hospital, and receive a small monthly stipend. Besides studying from text-books, and attending regular courses of lectures, they are occupied in the care of the patients in the wards of the hospital; they are taught how to make accurate observations and reports for the use of the physician, as to the symptoms and condition of the several patients—such as the state of the pulse, the temperature of the system, the breathing, appetite, sleep or wakefulness, the effect of the diet, medicines, and in fact everything which may aid the physician in judging of the condition of the patient and the result of his mode of treatment. At the conclusion of the two-years' course, and after passing a satisfactory examination, they receive a regular diploma, which is enough to insure immediate and fairly lucrative employment. The heads of the nursing departments of several of the principal hospitals all over the Union are graduates of the Bellevue school, but the greater number enter upon private practice. Something more than one-half of them are now thus engaged in New York, and their earnings are greater than the average made by skilled labor, by either men or women, in other departments, and fully equal to that of the average compensation of female teachers in the New York grammar-schools.

This training-school encountered at first many prejudices from various quarters — even from members of the medical profession, where it was least to have been expected. It was averred that a hospital was not "a proper place for a woman to visit" — certainly not for a young woman, unless, perhaps, she might be a sister of charity — and it was apprehended that trained nurses might set the authority of physicians at naught; but the profession has come fully to appreciate the value to them of such services, and they have not been slow to inculcate the same idea upon their patients. When the managers of the Bellevue Training-school first proposed to provide nurses for private families, the applications were so rare that it



AMONG THE WEEDS.

See Note 39.

was feared the idea of opening a sphere in this direction must be abandoned; but they persevered, and the call upon them for graduates is now greater than they can supply. Physicians are beginning to insist upon having their patients attended by a well-trained nurse in whom they can confide, and surgeons not unfrequently make it a condition, for the performance of a critical operation, that the patient shall be subsequently placed under the care of a person trained for such a position and approved by them. Without such co-operation they will not risk their own reputation or the life of the patient.

It may be anticipated that the time will come when it will be held just as essential that the professional nurse shall be educated in such an institution as has been described, as it is that the physician should have studied at some reputable medical school. But at present this can be attained only partially. There are several training-schools for nurses, but we suppose the whole number of their graduates does not exceed 1000, whereas the Census shows that there are (including midwives) nearly 15,000 female professional nurses, a good proportion of whom it is to be hoped have, in some fair measure, qualified themselves to fulfil the duties of their profession. In all cases of severe illness it is better to employ an ordinary nurse, if recommended by the physician, than for the well members of the household to share among themselves the duties of sick-nurse, or even, which is better, to devolve it upon one of their number. One nurse for an invalid is better than a number, just as one physician is better than half a dozen.

Health has, indeed, a value not in any way to be estimated in money; yet it has also a definite pecuniary value. While a man is sick he must spend more than when in health, and at the same time he is earning nothing. He loses, therefore, this extra sum expended and what he would have earned had he been well. No money is more economically expended than that which is paid to the competent nurse, when one can be had. The number of professional nurses is likely to be for some time to come altogether too small for the work to be done, and which they will be called upon to do more and more as the public become better enlightened upon this subject. This is emphatically one of the cases in which supply increases demand, and demand increases supply, and the limits of either in this department of woman's work are far from having been reached.

At present, and especially away from cities and large towns, and apart from those few households which are large enough and rich enough to be able to keep a regular nurse, the immediate care of the sick must be undertaken by the members of the family, and mainly by the female members of it. Almost every mother of a family, and very many of the unmarried daughters, will, at one time or another, be called upon to act as nurse, and not seldom in cases where a professional nurse would have been in every way desirable. It is assumed that, in case of any illness which threatens to be either protracted or immediately dangerous, a competent physician has been called in; and considering the number of those already in practice, and the number who honorably graduate from the great medical schools, it will be only in exceptional instances that the aid of a competently educated physician is not immediately to be had, even by the poorest. The first and paramount duty of the household nurse is to follow implicitly the directions of the physician. The medicines which he prescribes, and those only, should be administered.

Our newspapers are filled with advertisements of all sorts of nostrums, which it is averred are a sure cure for all the ills to which flesh is heir. Some of these are beyond doubt valuable remedies when properly administered. The physician will know, or should know, if this be the case, and, what is of the utmost importance, when and in what quantities they may be properly administered in this particular case. Do not give them unless by his direction. Turn a deaf ear to the representations of any neighbor who assures you that she has heard of some instance in which just such an ailment has been cured by such and such a thing. The more such friends you have, the more numerous will be the remedies urged upon you; and the more of them you adopt, the greater is the probability that you will kill instead of cure the sick person under your care.

There are certain conditions as to exposure, food, and the like, of which no person who is likely to have even the temporary care of an invalid should be ignorant. The sick person is always in an unnatural condition of body, and, in a greater or less degree, of mind also. You have to think for him as well as to act for him. It is for you to prescribe what he should do, not for him to direct what you should do for him or he should do for himself. You must govern him — directly, if you can, indirectly, if you must.

The appetite of an invalid is usually in a morbid condition, and to this you must be able to minister. It is not enough that you should know how to prepare the little delicacies fit for his use, you must know how to present them in a neat and attractive form, and at the proper moment. Sometimes the appetite is abnormally craving as to quantity or kind of food, but more frequently it is fastidious in both respects, or the very idea of any food is repulsive. A small portion of food, neatly served, and especially at an unexpected moment, will often be eagerly accepted when a larger quantity, coarsely served, would be involuntarily rejected. Nothing more effectually defeats its own purpose than the persistent urging of food upon an invalid. Do not be perpetually reminding the invalid of his condition, even by the most tender inquiries as to how he is feeling. Of course you must sometimes make such inquiries, but the more they can be dispensed with the better. Your own observation will usually tell you better than he can how he really feels and has been feeling.

There are circumstances in which silence in the sick-room, both on the part of the invalid and the attendant, is indispensable; but this may be carried too far. Few things are more oppressive than the ostentatious—one may say noisy—inculcation of stillness. In the sick-room, as well as elsewhere, there is a time to speak and a time to keep silent. When you do speak, do so as nearly as you can in your natural voice and with your natural manner. Few sounds grate so harshly upon the abnormally quick ear of an invalid as the sharp, sibilant whisper which is thought by many the equivalent for speaking low. When you have occasion to move around the room, or to enter or leave it, walk softly, indeed, but without any apparent effort to do so. Do not go tiptoeing from place to place. You cannot be too careful in all these respects, but the perfection of care lies in the avoidance of all appearance of carefulness.

The sick-room must at the best look like a sick-room, but it should look as little so as it can be made to do. The medicines should not be kept where the invalid can always be gazing upon them; his mind should be kept from them as much as possible. When the time comes for administering them, they can be brought forth as though it were a matter of course that they are to be taken: the chances of any opposition or revulsion will thereby be greatly diminished. The less the invalid broods over his condition, or thinks upon what the physician and nurse are doing for him, the better are their chances of success.

CHAPTER XLI.

AMUSEMENTS, PUBLIC AND PRIVATE.

BY amusements we mean in general all those occupations which are carried on mainly for pastime; those in which the labor is performed for the pleasure of doing it, rather than for the sake of any ulterior benefit to be derived from it. The same work may be an amusement to one person or at one time, and a labor to another. One man hunts or fishes for the sake of the game, and to him it is a labor; another does it for the sport, and to him it is play. Athletic games, from croquet and tennis to base-ball and cricket, are amusements to some; but the "professionals" find them hard work—and, we presume, not very lucrative. But play within due bounds is as useful as work; for one works all the better for having a proper amount of play.

We hold, therefore, that amusements of all innocent kinds, at proper times, and not in excess, are among the most useful of employments. Men and women need, as well as wish, to be amused, just as really as they need to be fed and clothed and taught; and they are as ready to remunerate those who provide them with amusements as to pay those who furnish them with food, clothing, and shelter. A list of those who have found opportunities for success in catering for the amusement of the public would be a long one.

The stage, dramatic and lyric, comes foremost in the catalogue of public amusements. Of this, and the opportunities which it presents, and the disadvantages to which it is exposed, we have already spoken at sufficient length. Of music, when practised as a profession, whether by way of teaching or of performing, we have also spoken. But something may here be added by way of suggestion to those who wish to derive pleasure and profit from this and other amusements, without making them a regular profession.

Every town, next after its school-houses and churches, should provide itself with a commodious hall for amusements, capable of accommodating as many persons as are likely to be assembled for such purposes ; it is better to have some room to spare than not to have quite enough. The town-hall, if built also with a view to such purposes, might, perhaps, suffice. At all events, there should be some such public hall, to be open to the public upon suitable conditions. It might be well that it should be open to hire on moderate terms for any unobjectionable entertainment—a concert, a lecture, a reading, or even an exhibition of ventriloquism or sleight of hand. Where there was upon any occasion a fee for admission, a rental should be charged. But the essential feature should be that of a free hall, open, at least upon certain evenings, for free entertainments, more especially for musical ones, which there should be no difficulty in providing, if a few public-spirited citizens would take the matter in hand.

In every town where there is a considerable German element in the population there is certain to be abundant materials for forming musical associations, vocal or instrumental, or both ; and it is among the things upon which we have reason to congratulate ourselves, that this Rhineland scion has been so largely grafted upon American stocks. Every such association would be more than willing to play or sing without pay on certain evenings of the week, provided a hall fitted for the purpose, and properly lighted, and warmed when necessary, were provided. If there were an afternoon concert, say on Saturdays, so much the better. Now let the public-spirited citizens, whom we have presumed to exist, provide the funds for defraying the small necessary expenses, and place the matter of arranging the successive programmes in the hands of a committee, and the work would be done. If there were such an entertainment every evening, it would probably be worse for the saloons, but all the better for the community. Many a young man betakes himself to the liquor-shop simply because he has nowhere else to go for amusement in the evening. Many a family passes weary evenings at home, not because the home itself is unpleasant, but because it presents no variety. One evening, passed as has been suggested, would break up the monotony of the whole week. It needs but a small bit of leaven to lighten a great mass of what would otherwise be very heavy dough. One great problem of living is to make the home one to be contented in. One's town is in a wide sense his home. If this be a dull place he will always wish to get away from it. That life outside of our cities is apt to be dull is not to be denied; and herein lies the chief cause of that craving for city life which pervades the country to an unhealthful extent. Make home cheerful and few persons will leave it for light reason.

In many manufacturing towns the advantage of doing what has here been suggested has forced itself upon the attention of the far-seeing men who control the establishments without which these towns would have no existence. It is coming to be more and more common to do even more; to establish a free library, reading-room, and sitting-rooms, open to all employees. Self-interest, as well as higher motives, prompts to this. It is for the interest of employers to be able to secure the best operatives, and to make sure of retaining them. It is for the interest of good operatives to stay in a place where the surroundings are pleasant, even though the wages are no higher than elsewhere. These manufacturing corporations can do this more efficiently and economically than the operatives could do it for themselves. The cost is really so much in addition to the nominal wages, and should be so regarded by both parties, and not in any sense as a gratuity. Those who enjoy the benefits of all this really pay for them. One of our prominent thread manufacturers was asked why his firm took so much care for the operatives in his mills in this respect. "Because they make so much better thread," was the reply.

Very many of the corporations look to the social and domestic comfort of their operatives. They build boarding-houses, which they let at a low rent, and only to persons of approved character. These are built contiguous to the factories, and are under as strict supervision as any other portion of the establishment, of which they are really a part. The following is extracted from the regulations of one of the largest New England manufacturing corporations:

"The tenements of this corporation are expressly for the accommodation of persons in its employ. They are not to be underlet by the tenant of the company, nor are persons not employed by the corporation to board in them, except by special permission; and males and females will not be allowed to board in the same house, except by permission given in writing by the agent. It is expected that all children between the ages of twelve and fourteen, living in the company's houses, will be kept constantly at school. It will be strictly required that all who live in the houses shall be vaccinated, which may be done by a physician employed by the company, and at its expense. A suitable chamber for the sick must be reserved in each house; and if any contagious disease is suspected, notice of it must be at once sent to the counting-room. The doors are to be closed at ten o'clock in the evening. Rude or disorderly conduct will at no time be permitted; and the tenant will be held answerable for any such from visitors allowed to remain after the time of closing.

"The tenants will, when required by the agent, give to him, in writing, so far as is within their knowledge, a correct account of the number, names, character, habits, and occupations of their boarders. They must send to the counting-room, on the first Monday of every month, a list of all the boarders they have taken, and of all who have left their houses during the preceding month, and must not discharge any boarder without first giving notice to the agent of their intention. If any person leave for the purpose of boarding off the corporation, immediate notice must be given at the counting-room.

"Conformity to these regulations will be strictly exacted, and tenants will be held answerable for the observance of them on the part of their boarders. The tenements will be inspected once a month by the agent, to see that everything is kept in proper order, and in a manner satisfactory to the corporation."

The regulations also contain strict provisions as to the daily ventilation of the houses, and for the cleanliness of every part of the premises. If the observance of these regulations be rigidly insisted upon by the agent of the corporation, who is its chief executive officer in every department, it will be impossible that disreputable occupations should be carried on, or disreputable persons find harbor within the corporate limits of these companies; and for many purposes each of these corporation grounds is practically a city ward. The surveillance which the corporation is thus enabled to exercise over every person in its employment is of a kind and degree to which no law-abiding person can object. It is a power which every good citizen desires that his own municipal government should hold and exercise. The result is that in those manufacturing towns where this system prevails, the standard of morals among the factory operatives is exceptionally high, and compares favorably with that of the general community.

Our great sea-side places of summer resort for pleasure bear, in some respects, a close analogy to these manufacturing towns. The ground is in almost every case under the control of the proprietors of the hotels and other establishments, and no disreputable business can be carried on to any great extent, or for any long time, without their sanction, or, at least, their connivance. If there is a gambling den, a swindling establishment, or a disorderly house of any kind, these men must know of it, and could easily repress it if they chose so to do. They own the buildings in which these misdemeanors are committed, or, at least, have the control of the ground upon which they stand; and they could have the leases so framed that their premises should be vacated upon proof of any improper practice. They may not be able to prevent disorderly people from coming there, but they can, to a great extent, see to it that they behave themselves while there; and such people are not fond of seeking pleasure where good order is enforced.

Very much of the attractiveness of these places depends upon the nature of the amusements presented. People visit them mainly for relaxation, for a change from the daily routine of their lives. The amusements will therefore be mainly of a light character. One will hardly go to Coney Island to attend a scientific lecture or a literary discourse; to hear an oratorio or a sacred concert. Of course, there is nothing to be said against those places of resort where the religious element is made a predominating feature. A camp-meeting by the sea-shore is an excellent thing, as far as it goes; but it fails to meet some very proper requirements of the great mass of pleasure-seekers.

The amusements at such places must be mainly such as can be enjoyed out of doors. Men do not leave the brick and mortar walls of the city to shut themselves up in wooden or iron walls, or even in a canvas tent, upon the sands of the beach. As it happens, the means of access to these sea-side resorts are mainly in the hands of proprietors, who own also the railroads and steamboats running to them. The conveyance of passengers is one of the great items of profit; and the amusements provided are chiefly for the sake of attracting passengers, and the cost of the amusements is really included in the price of the ticket for passage.

Good music, especially that of a fine band, stands foremost among the amusements adapted to such places. It is, indeed, one of the very few out-door amusements in which a crowd can participate. An exhibition of fire-works is coming to be a necessary part of sea-side attractions. Music, as such, stands almost alone in this — that it refuses to be a medium for the conveyance of low and ignoble thought. The purest tones of the voice, or notes of the instrument, may be made to express impure thoughts by forcing them into union with filthy words or obscene gestures; and the tune, when sung or played, may suggest those base ideas. But that is an abuse to which all good things are liable. A pen-knife is not a bad thing because it may be made an instrument of murder. It is always possible to steal the livery of heaven to serve the devil in. Music may, perhaps, not always be positively ennobling, but it is never of itself debasing. A musical entertainment, moreover, presents little opportunity for gambling. Men will bet untold sums upon a half-second's time in the speed of a race-horse; but one never hears of a wager whether the voice of a singer will touch a certain difficult note.

There can be no doubt that many of the amusements almost universally concomitant with our pleasure resorts are highly objectionable; and it may be a matter of question whether the evils connected with these places, as they are at present conducted, do not outweigh their benefits. But it is a cheering circumstance that the popularity of these resorts, especially of those close by large cities, is very nearly in the ratio of the quality of the public amusements provided; notably, of the free musical entertain-

LOST LENORE.

See Note 40.

ments. That which is really good is a leading attraction for visitors. It pays well to provide a good band; and it pays best where the best band is provided. Taken in its broadest acceptation, the question of amusements is one which should enter very much into consideration in the choice of a home. The ancient Romans, not altogether unwisely, placed "bread and the games" side by side as things to be looked after. If we were to rank things in the order of their importance, we should say that a community should be well-taught, well-fed, well-housed, well-clothed, well-amused, and well-governed.

Variety is the very essence of all recreation; and recreation is actually, what it is etymologically, a "re-creation," a giving of new life. Anything pursued unintermittingly becomes wearisome, no matter how pleasant in itself. If the conditions of the life hereafter are at all like those of the life here, we imagine that the spirits of the redeemed will have an endless variety of celestial joys. All innocent amusements are to be cherished in their due place and degree. Some of them, at least, should be such that persons of all ages and both sexes can participate in them together. The home which is stratified into three separate layers, parents, grown-up sons and daughters, and children, is not the ideal one. They should melt into each other in their occupations and amusements. Out-door recreations are still a desideratum for most American women and many American men. Croquet, lawn-tennis, quoits, and the like, are excellent; archery is admirable, and there is no reason why a woman should not be a good pistol-shot. Social home games should not be overlooked. The man who invented backgammon or checkers or chess was a benefactor to the human race. The inventor of many a toy or game has reaped well-earned wealth; and there is yet room for more such.

Many persons labor too much. Not that they accomplish too much work, but that they are engaged too many hours upon a stretch. The weekly Sabbath—viewed merely as a day of rest, and quite irrespective of its spiritual relations—is a profitable institution. We should have some hours of rest and recreation at the close of each day. Daylight, in our latitude, at most seasons of the year, is more than enough for doing all that any one should regularly perform. When men had little more than their hands with which to accomplish their daily tasks, a longer period was needed to produce what was required for sustenance and comfort. By the aid of machinery and implements not only is the possible product of labor indefinitely increased, but the time is greatly diminished. It has been estimated that, had we only the spinning-wheel and hand-loom of our fathers, it would require sixteen millions of people to produce the cotton cloth consumed in the United States, which is actually spun and woven by one hundred and sixty thousand. That is, one person, with our present spinning and weaving machinery, does as much work as one hundred could do with the implements in use less than a century ago. But the spinning-wheel and hand-loom are machinery quite effective when compared with the distaff and loom of savage tribes. If they had only these, all the working population of the country could not make enough cloth to clothe us as we are now clothed. Savage nations must mainly clothe themselves with the skins of wild beasts or go naked or half-naked. The same holds good in a greater or less degree in agriculture, mining, fishing, and almost every industrial vocation. In all of them machinery must inevitably produce great changes in the modes and conditions of our daily life. There is no probability that these changes will be less in the next than they have been in the last half century. There is no certainty that the application of machinery has reached its limit in any direction; it is certain that it has not in most directions.

The bearing of all this upon the subject of Amusements is evident. If, through the introduction of labor-saving machinery, all the necessities, comforts, and conveniences of life can be produced by fewer hours of labor than they now are, then working men and women should have more hours which they can devote to recreation. It is useless to talk of providing amusements and recreation for men and women who have, and can have, no time to enjoy them, no matter how much they may need them.

If the increasing adaptation of labor-saving machinery into every department of industry has had, and must continue to have

—as is maintained by some—the effect to depress the condition of the laboring classes, who must always constitute the majority of the community, then we are forced to the conclusion that it is a public evil of a magnitude which cannot be overstated.

This general subject has been touched upon incidentally in various places in this volume. It is proposed to consider this question more specifically in the next chapter.

CHAPTER XLII.

LABOR-SAVING MACHINERY AND WORKING MEN.

IN considering the influence of labor-saving machinery upon the past, present, and future condition of those who must always constitute the great majority of the community—and who are, in fact, the community—it must in the very outset be admitted that the use of machinery to displace manual labor does, in many cases, act unfavorably upon individuals. The artisan or operative who is even temporarily thrown out of work by a machine is in most cases injured thereby. Sometimes the injury is compensated by the increased demand for his productions, occasioned by the greater cheapness. As before noted, there are more printers than there would have been if no other than hand-presses had been invented. In the printing of books there are more persons employed than there would have been in the copying of them, had there been only scribes to multiply copies. But the cases are numerous where there is no such compensation. There are, for example, fewer nail-makers required than there would have been if nails were made only by hand, and one or two hundred nails was a good day's work.

But, taking a comprehensive view of the whole question, there is in our mind no doubt as to the general conclusion to which we must come: Machinery — taking the word in its widest signification, so as to include the most complex as well as the simplest kinds of labor-saving implements—adds largely to the sum of human comfort and therefore of human well-being, however much its introduction may temporarily injure a few individuals. Those workmen, indeed, who are, on the one hand, injured by being brought into direct competition with machinery, are, on the other hand, benefited by its competition with others. Every workman buys what he needs at a lower rate than he could have done had not its production been made more easy, and therefore cheaper, by machinery.

Nothing which grows or is produced is of any value to man unless it can be in some way used—that is, consumed—either at once or hereafter. If in some South Sea island there are more plantains or cocoanuts spontaneously growing than can be eaten, the overplus is worthless; if—of which there is no likelihood—the world should come to raise more wheat or corn than it can consume, the surplus must rot on the fields or in the barns; if the cotton crop is twice as much as can be sold, one half of it would be worth just as much as the whole; should we weave more cloth than can be worn, the excess represents just so much labor thrown away; and, as the possible limit of consumption is being reached, the production will slacken or cease altogether, until the balance between supply and demand is restored. But what would be an overplus at one time may be a deficiency at one not very far distant. It is not quite four centuries since the greatest book-printers in Rome complained bitterly that they had accumulated some twenty thousand copies of their publications, and were on the point of ruin because there were no more purchasers. Guttenberg's first edition of the Bible consisted of only a few hundred copies, and it glutted the book-market of all Europe for years. Here is one of the innumerable instances in which the possible supply has actually created the existing demand.

The case is just this: We are constantly producing more and more, in proportion to population; everything that is produced is in the long run consumed, that is, put to use, or thrown away as useless; increased consumption implies increased comfort. Therefore the people, in the mass, are, with us at least, better off than they were. We are, as elsewhere stated, better fed, better housed, and better clothed than our fathers were; and if we are not also better taught and better governed, the fault is our own. We have in that case neglected to avail ourselves of our opportunities. All this is owing, in a great measure, to the increased use of machinery in manifold industries. Considered from the industrial point of view, the benefits derived from labor-saving machines may be thus summed up: The benefits arise from the addition which they make to human power; the economy which they produce of human time; and the conversion of many substances, otherwise worthless, into products which minister to human comfort and well-being.

If we, in imagination, put ourselves back into the times before the general application of labor-saving machines to our great industries, we shall be able, in a measure, to apprehend what we should lose by their even partial abandonment. How many of the things which we have come to regard as absolute necessaries of life could we have had without machinery to produce them?

There are, indeed, few people who would, in this respect, be willing to go very far back in any one direction — to be obliged to use the tinder-box and flint instead of lucifer matches; to fall back upon pine-knots and tallow-dips in place of kerosene lamps and stearine candles; to replace gas by whale-oil; to wear linsey-woolsey and homespun linen instead of broadcloth and muslin; to give up steel-pens, and go back to quills. But there always have been, and we suppose there always will be, those who in respect to their own immediate vocations would have the world stand still. They have adjusted themselves in some tolerable degree to things as they have shaped themselves, and do not wish to be disturbed, although they are quite content that the rest of the world should be discommoded by being brought into competition with labor-saving machines. The British farm laborers did not wish to go back to the hoe and pointed stick instead of using the deep-cutting plough; but they set themselves against cultivators and reaping-machines. The carriers did not wish to abandon their vans, and go back to pack-horses; but objurgated against railroads. The spinners and weavers were quite willing that the foot-wheel and hand-loom should keep the place from which they had driven the distaff and treadle; but they broke up Arkwright's spinning-frames and Jacquard's power-loom. The London printers, who had learned to work Applegate's power-press, did not wish to go back to Stanhope's hand-press; but when the *Times* introduced the steam-press, the premises had to be guarded by the military.

But it may be assumed that no effort will be permanently successful which aims to prevent the introduction of labor-saving machinery in any case where it can do its work better or cheaper than it can be done by hand. If the machine is stronger or more skilful than the workman it will inevitably supplant him, just in the degree that it is so. If watches can be made more economically by machinery than by hand, they will be thus made; because, when a man purchases a watch, or anything else, he buys it where he can do so for the least money. But skilful as the machine may be, there are yet things which require a kind or degree of skill which it does not possess. The highest and the rarest skill in any department of industry is that which is always best paid. The workman who can do something which is beyond the skill of the machine is not brought into competition with it; and therefore his wages are increased rather than lowered by the machinery; for he in so far supplants the machine, instead of the machine supplanting him. Hence we confidently affirm, as the result of all experience as to the relations between skilled human labor and labor-saving machinery, that, all things taken into account, *the result of the most intelligent application of machinery to most branches of industry is a large increase of production coupled with comparatively high wages to the skilled workman, provided that the educated skill of the workman keeps pace with the improvements in the machinery, but not otherwise.*

The machine will supplant the man if it can; and it can do so only by doing the work more cheaply. The workman can succeed in the contest only by keeping ahead of the machine in skill. It must, moreover, be borne in mind that skill is a comparative term, not an absolute one. A man who would have ranked as a very skilful workman or artist a dozen years ago, would be at best considered to-day as a moderately skilled one. Look, for example, at the very best specimens of wood-engraving produced twelve years ago, and compare them with those presented in this volume. The human worker has individually two advantages over the machine. He can keep on increasing his capability, while the individual machine is almost stationary; to make any essential improvement in it is to make a substantially new machine. Moreover, the machine can do only the specific kind of work for which it was designed. The drill-planter cannot reap, or the reaping-machine plant; while the agricultural laborer can plant and reap, and do a hundred things, each of which would require a separate machine, and many of which can never be done by a machine.

In making choice of an occupation, it stands one in hand to consider whether it is one in which he is likely to be driven out by machinery, for such a probability is a serious drawback. A wise man will not be contented with the ability to do a single thing, no matter how well he may do it. The farmer who confines himself to a single crop runs no little risk; if it fails, he is ruined; but it is not likely that all crops will fail in any one season. Let him have something to fall back upon in case his main crop fails. So of the craftsman. It will necessarily take much of his attention to perfect himself in the vocation which he has adopted. But no one occupation, however earnestly it be followed, brings all the powers of a sound man into exercise. There may, indeed, be now and then a "Blind Tom," who can do some one thing admirably, and can do nothing else; but no wise man will try to develop himself into any sort of a Blind Tom. The cases are rare in which a man will do any one thing the better just because it is the only thing he knows how to do. In a practical point of view, the man who can in case of need turn his hand and brain to several purposes has a great advantage when compared with him who must do one thing or do nothing at all. He has more than one string to his bow, more than one barrel to his rifle. There are, of course, limitations in this direction; for, while most men can learn to do several things, often quite different, very well, few men can have time to learn to do very many things, and no man can learn how to do everything.

The great problem of success in life is to be able to avail one's self of opportunities—opportunities, not only to seize a

THE SISTERS.

See Note 41.

desirable position, but quite as often to escape from an undesirable one. One must not forget that the occupation which is a profitable one to-day may become an unprofitable one hereafter. The stanchest ship may encounter an iceberg, or be struck by a cyclone. It is well to have a life-boat in case of emergencies, even though there may never happen to be occasion to launch it.

The bearings of the competition between labor-saving machines and unskilled labor involve some further consideration. If machinery could not be used in ploughing and mowing, digging and lifting, and the like, there would not be men enough in our generation to do the work which is actually accomplished. Our railroads, for example, could not be constructed at anything like their present rate by mere manual labor. It is clear, however, that the wages paid for this class of labor is higher than it was at former times. There are not at hand adequate statistics, except for agricultural employees. These, as given in a preceding chapter, show a continual increase, except when there have been retrogressions at times of general financial depression; and agricultural labor may be presumed to be a fair type in this respect. If a man can earn more money by working on a railroad than on a farm, he will seek that employment, and *vice versâ*.

But this book is designed for those who are in search of opportunities for success in life; and the man who remains in the position of an unskilled laborer has not attained that measure of success which we have in view. That, surely, is not the condition of life in which any man should pray to be contented, either for himself or his family. The first thing for one to do who finds himself in this condition is to escape from it if he can. The figures given in the chapter on agricultural laborers evince that, by industry, economy, and prudence, a young man may, in a few years, accumulate sufficient capital to enable him to own his own farm, and so make a new start in life with ample opportunities before him for further success. And what is possible for the agricultural laborer is not impossible for many other unskilled laborers, although the obstacles are greater and the opportunities fewer. One circumstance to be taken into consideration is this: the agricultural laborer, while working as such, is practically learning his future profession of farmer; while most other laborers, as such, learn only to do the thing which they are about. The hod-carrier learns only to carry his load; the street-sweeper only to handle his broom.

This brings us back to a subject to urge which has been a leading purpose throughout this whole volume: the importance of a more useful, and therefore a higher, education than has hitherto been secured by our institutions of learning. The question was asked of a wise man of old: "What should a boy be taught?" The answer was: "That which will be useful to him when he becomes a man." We grant that there is an apparent deficiency in this, for there are things useful to a boy, as such, which will not be useful to him when he becomes a man. The person who has learned to swim throws away his cork float or swimming-bladder. But the deficiency in statement is more apparent than real. That which has been useful to the boy, as such, is useful to him when he comes to be a man. Whatever has made him a better or a happier boy tends to make him a happier and a better man, and it was wise to instruct him therein. But it is a grave question how much that is taught in our schools, with such infinite trouble to teacher and pupil, is of any real use to boy or man? How much of it is thrown away, not because it has fulfilled its uses, but because it never had any use at all? And the worst of this is that all this useless instruction takes up the time which should have been devoted to better purposes.

And again, as no man can learn everything worth learning, it is folly that everybody should study the same thing. It is quite necessary that there should be men who can repair a watch; but it by no means follows that every boy should learn the trade of watch-maker. It is quite desirable that there should be a few men who can read Cicero and Virgil; but it does not follow that every boy should spend half the years of his pupilage in mastering the Latin Grammar.

There is an altogether groundless apprehension in some minds that the masses of the people will become too highly educated. A common expression of this apprehension is: "They will get to be above their business." That is, if common people learn too much there will be nobody left to perform the common work of life. Society will develop into the condition of an army in which all are officers, with no privates under their command. We think that there is no danger likely to arise in this direction. Do the best we may, there will always be enough, and more than enough, of men and women who have not the ability to fill any other than the lowest positions. The crowding is at the bottom, not at the head of the stairway. The more that labor-saving machines enable human beings to impress the forces of inanimate nature into their service in doing the harder work of life, the more scope will there be for the exercise of the educated powers of our being. Towards this end we believe that humanity is tending under the wise government of the Creator. And in active obedience to his law and rule lie the World's Opportunities for advancement and success.

CHAPTER XLIII.

HEALTH AND MORTALITY.

IN Great Britain and some other countries there is a system of registration by which the annual number of deaths is ascertained with a close approximation to accuracy. In the United States there is, unfortunately, no such system, except in about four States and in some of the larger cities. For the remainder of the country the number of deaths, as returned by Census enumerators, has always been much below the true number. In 1860 the number thus reported was 12.5 to every 1000 of the population; in 1870, as 12.8 to the 1000; in 1880 the number reported was 756,893, or 15.1 to every 1000 of the population. "But this," says the Superintendent of the Census, "does not indicate any actual increase in the number of deaths as compared with the population; it shows, rather, that the efforts made in the Census of 1880 to obtain more complete returns of deaths than had been collected in previous enumerations have been to some extent successful."

As, however, there could be no doubt that the enumeration of 1880 was yet defective, an effort was made to remedy the defect. The effort was thorough and exhaustive, and there is every reason to believe that a close approximation to the truth has been attained. The result, partly by estimate, is that the number of deaths in the United States, during the Census year 1880, instead of the 756,893 reported by the enumerators, was 914,442, being 18.2 deaths to every 1000 of the population. "The actual mortality for the whole country during that year," says the superintendent, "was not less than 17 nor greater than 19 per 1000 of the population. This rate compares favorably

THE GHOST IN "HAMLET."

See Note 42.

with that of other civilized countries. The death-rate for the whole of England during that year was 20.5 per 1000; for Scotland, in 1878, it was 21.3 per 1000." He considers that "the low death-rate in this country is due to the comparative absence of overcrowding, and to the more general and equable distribution of the means of supporting life, including, especially, the abundant food-supply of good quality for all classes of people."

In all the statements which follow the figures are those given in the Census enumeration, not as they would have been in the corrected statement of the Bureau, where, when absolute numbers are concerned, they would have been greater by a little more than one-fifth (21.6 per cent.). In all such cases sufficient accuracy will be attained by adding one-fifth to the numbers as given. Thus, the number of deaths by consumption is put down at 91,551; add one-fifth, and the result will be 109,861—a close approximation to the actual number; and so of the other diseases enumerated. But as in most cases the figures given are comparative, showing the relations of various causes of death to sex, age, and locality, the value of the conclusions drawn from them will be only slightly affected by the deficiencies referred to. Thus, when it is stated that of every 1000 deaths 87.57 were between the ages of five and fifteen, 299.66 were between fifteen and sixty, it is of no consequence what were the absolute number of deaths, for the proportion is the same, whatever may have been the actual number. In the few instances where misapprehension would arise, the number given in the Census enumeration is followed by the correction enclosed in brackets. Thus, "the mortality of the white population was 14.74 [17.69], and that of the colored population 17.28 [20.75], that of the entire population being 15.1 [18.2] per 1000."

Of the 756,893 enumerated deaths 23,053 are unaccounted for, leaving 733,840 the causes of which are assigned. Of these there were 35,932 deaths from accidents and injuries of all sorts (including homicides and suicides), so that the entire reported deaths from all ascertained diseases was 697,898. The number who died from eleven of the principal forms of disease was as follows: Consumption, 91,551; diphtheria, 38,398;

enteric (typhoid) fever, 22,905; malarial fevers, 20,261; scarlet fever, 16,416; whooping-cough, 11,202; measles, 8872; diarrhœal diseases, 65,565; diseases of the digestive system, 34,094; of the nervous system, 83,670; of the respiratory system, 107,994—in all 500,728, or 72 per cent. of all the deaths from disease, leaving 197,162, or 28 per cent., from all other forms. By adding one-fifth to each of these numbers the actual number of deaths from any of these causes will be approximately ascertained, but their relative proportions—which is the main point under consideration—will not be changed.

The death-rate is very sensibly affected by numerous special circumstances, among which are color, sex, age, locality, and climate, which will be considered in their order.

Color.—The death-rate is considerably higher among the colored than the white population. Taking the whole together, it is 15.1 [18.2] deaths to 1000 of population: among the whites it is 14.74 [17.69]; among the blacks, 17.28 [20.74] to the 1000. This difference is especially observable in those States in which the proportion of colored population is the largest. In the judgment of the Census Bureau "this difference is largely due to the relatively great number of deaths among infants in the colored population."

Sex.—The death-rate among males is decidedly higher than among females. In males it is 15.35 [18.42], and in females, 14.81 [17.77] to 1000 of population; or, for every 1000 females who died there were 1074 males, according to the returns of the Census. The Census Bureau, while giving these numbers, adds, without assigning its reasons: "It should be borne in mind, however, that the proportion of female to male deaths is somewhat greater than these figures would indicate." The disproportion between the male and female death-rates, as returned, is very notable in the case of children. The Report says: "The proportion of male deaths of those under five years to all the male deaths recorded was 419.51 per 1000; the proportion of female deaths of this age was 381.85 per 1000." No reason is assigned why the male deaths of young children should thus exceed the female deaths by 37.66 in 1000, or nearly 4 per cent.

Age.—The respective ages at which the deaths occurred were as follows:

Five years and under	440.37	in 1000
Between five and fifteen years	87.57	"
Between fifteen and sixty years	299.66	"
Over sixty years	172.40	"
	1000.00	

It thus appears that a little more than 44 per cent. of the deaths occur before the individuals have completed the fifth year of their age, and fully one-half of these die during their first year.

Locality.—The corrected average death-rate—that is, the ratio of the number of deaths to each 1000 of the population—as compared with that of other countries, shows that the climate of the Union, as a whole, is salubrious. There are, however, some portions in which, at certain seasons, at least, it is comparatively unhealthy; but no very large districts are positively and permanently pestilential. The Census Report gives for each State the number of deaths returned as having occurred during the Census year, and, by comparing these with the number of the population, the actual death-rate could have been positively ascertained had all the deaths been enumerated; but, as has already been said, this enumeration is manifestly imperfect. Still, even these defective data are of much value for purposes of comparison. As given in the Report, the number of deaths to each 1000 of the population of respective States was as follows:

Alabama, 14.20; Arizona, 7.3; Arkansas, 18.4; California, 13.3; Colorado, 13.1; Connecticut, 14.5; Dakota, 9.6; Delaware, 15.1; District of Columbia, 23.4; Florida, 20.5; Georgia, 14.0; Idaho, 9.8; Illinois, 14.5; Indiana, 15.6; Iowa, 11.9; Kansas, 15.2; Kentucky, 14.4; Louisiana, 15.4; Maine, 14.7; Maryland, 18.0; Massachusetts, 18.7; Michigan, 12.1; Minnesota, 11.6; Mississippi, 13.0; Missouri, 17.0; Montana, 8.6; Nebraska, 13.1; Nevada, 11.7; New Hampshire, 16.0; New Jersey, 16.3; New Mexico, 20.0; New York, 17.4; North Carolina, 15.0; Ohio, 13.3; Oregon, 10.7; Pennsylvania, 16.0; Rhode Island, 17.0; South Carolina, 15.8; Tennessee, 16.8; Texas, 15.5; Utah, 16.7; Vermont, 15.1; Virginia, 16.3; Washington, 10.1; West Virginia, 12.0; Wisconsin, 12.2; Wyoming, 9.0.

The population of the Union being 50,155,783, and the number of reported deaths 756,893, the average death-rate was 15.1. In sixteen States the number does not vary from this by more than 1 in 1000 either way; in thirteen States it exceeds this proportion, and in eighteen States it is less. Some of these variations admit of easy explanation: The high death-rate in Florida is owing to the fact that this State has become a resort for invalids, many of whom die there instead of at their homes; and the population of the State being small, a comparative few of these foreign deaths considerably affects the death-rate. The high reported death-rate of New York is caused partly from the fact of the city being the landing-place of the greater part of the emigrants from abroad, the sick remaining and dying there. In the States in which the colored population is comparatively large, the proportion of unreported deaths is doubtless unusually large, rendering the death-rate apparently smaller than it actually is.

The most noticeable deviations from the average occur in the newly settled and sparsely peopled States and Territories, in some of which the death-rate is less than two-thirds of the average. This is to be explained mainly by the fact that the immigrants, who form the bulk of the population, are generally men in the vigor of manhood; it does not, therefore, indicate of itself that the climate is unusually favorable to health. It may, moreover, be laid down as a general rule that to attain completeness in such statistics is much more difficult in a thinly settled region than in one more densely peopled. All these considerations should be taken into account when estimating the comparative healthfulness of any State from these mortuary statistics. It is not to be assumed that the climate of Arizona or Dakota is more genial than that of Delaware or Vermont, because the death-rates are not half as high.

It should also be borne in mind that the various conditions of climate often vary greatly in different portions of the same State. In New York the climate is very different in the Adirondacks, upon the shores of great lakes, and upon the banks of the Hudson. What would be true of one part of Virginia or

California or Texas, would be quite untrue of other parts—and so, to a greater or less degree, of nearly every State or Territory. The nature of the surface, and the proximity to or distance from the ocean, are important; mere State lines are in this respect of no consequence, except as they indicate geographical position.

For the purposes now under consideration, the Census Report divides the entire Union into twenty-one "Grand Groups," quite irrespective of State boundaries. Three of these groups, composed of portions of some half a dozen States, present marked distinctive features, especially in regard to the more prevalent diseases, and are treated with some detail:

The North Atlantic Group comprises Rhode Island, and the portions of Connecticut, Maine, Massachusetts, and New Hampshire bordering upon the ocean. The population of this group was 2,617,210, the deaths 45,358—being 17.3 to 1000. The deaths from consumption were 16.5 per cent. of the whole; from diphtheria, 5.3 per cent.; from enteric fever, 1.9 per cent.; from malarial fevers, .04 per cent.

The Great Lake Group comprises those counties of Illinois, Indiana, Michigan, New York, Ohio, and Wisconsin bordering upon the great lakes. The population of the group was 3,049,412, the deaths 43,578—being 14.2 to 1000. The deaths from consumption were 13.0 per cent. of the whole; from diphtheria, 8.1 per cent.; from enteric fever, 2.2 per cent.; from malarial fevers, 9.7 per cent.

The Gulf Coast Group comprises Florida and those counties of Alabama, Louisiana, Mississippi, and Texas bordering immediately upon the Gulf of Mexico. The population of this group was 1,056,124, the deaths 16,124—being 15.3 to 1000. The deaths from diphtheria were 1.2 per cent. of the whole; from enteric fever, 2 per cent.; from malarial fevers, 6.6 per cent. Consumption, in this group, also causes more deaths than any other disease—the deaths being 11.8 per cent. of the whole. In New Orleans, which is in this district, the ratio of deaths from this disease is higher than in the Northern cities—being 15.2 per cent. of the whole—while in the remainder of the group it is 9.8

per cent. This prevalence of consumption in New Orleans "is probably due to the fact that the city is not sewered or drained, and has the soil-water very near the surface."

It is doubtless true, as appears from the foregoing, that the death-rate in the northern region bordering upon the Atlantic is considerably higher than the average for the whole Union, and higher than in most other sections; but the disparity is somewhat less than these figures would indicate, for the population here is more congregated in towns and cities, so that the number of deaths returned by the Census enumerators approximates somewhat more nearly than elsewhere to the true number. This section is decidedly unfavorable to persons with consumptive tendencies. Consumption is decidedly more prevalent among females than among males—the number of males reported as having died from this disease in all the States being 40,619; of females, 50,932.

The climate of the region bordering upon the great lakes is decidedly favorable to human life, as is shown by the death-rate above given.

The portions of the Southern States lying upon the Gulf of Mexico, from characteristics of the population, present unusual difficulties to ascertaining the actual number of deaths. The real death-rate is undoubtedly somewhat higher, compared with other sections, than is indicated in the Census returns, and is, perhaps, not less than that of the North Atlantic group.

In regard to the comparative healthfulness of cities, the Census Report says: "The figures show that neither diphtheria, enteric fever, nor consumption are especially the diseases of large cities. They appear to be the more prevalent in the small towns and rural districts which have no general water supply or systems of sewerage, but obtain their water from springs and wells, and observe the usual custom of storing excreta in cesspools or vaults;" and, as above noted, the exceptional prevalence of consumption in New Orleans is attributed to the lack of drainage and sewerage. In large cities, where there is a system of registration of deaths and burials, the death-rate will be apparently higher than elsewhere, because in them every case of mortality

CLOUD EFFECT ON MOUNT LAFAYETTE.

See Note 43.

is ascertained and recorded, while elsewhere many deaths occur which are not recorded at all. It is estimated that "in the Census of 1870 there were 41 per cent. of the deaths occurring during the Census year which escaped record;" and, in spite of the greater attempts at accuracy, it is estimated that the omissions ranged from 13 per cent. in Massachusetts and 20 per cent. in New Jersey to 30 per cent. in some other States. The Superintendent of the Census says, emphatically, "The United States are at a marked disadvantage in comparison with almost any other civilized nation in the matter of vital statistics. We know not the number of persons born or dying in any year of our political history." We know, indeed, that the number of births must largely exceed the number of deaths, because the net increase of population exceeds by far the total number added to it by emigration from other countries. Leaving immigration out of view, the total increase of population must be just the excess of births over deaths.

This subject has been treated at length because the consideration of health should be paramount. What advantage is gained if in securing wealth the time for its enjoyment is materially shortened? What chance will a broken-down man have in his efforts to succeed in life?

CHAPTER XLIV.

CLIMATE, TEMPERATURE, AND RAINFALL.

THE adaptation of any region for human habitation depends mainly upon its climate, by which is to be understood the conditions of the atmosphere in regard to heat and cold, dryness and moisture, for these chiefly determine the character of the animal life and vegetable productions of any region. The United States lie wholly within the temperate zone; but so nearly do they approach the tropics on the south and the Arctic circle on the north that the range of temperature is very great. The healthfulness of any region is also very much determined by its climate. There is no considerable part of the United States which can be regarded as positively insalubrious; but each section has some classes of diseases more especially incident to it. Persons afflicted with or predisposed to one class of diseases will find some districts more favorable to their health than others, while these same districts would be less favorable for persons differently affected, or having different constitutions or habits.

TEMPERATURE.—The heat or cold of any place depends upon its distance from the equator more than upon any one other thing; but there are numerous modifying influences. Elevation above the level of the sea is one of these. Thus the line of perpetual snow within the tropics is at an elevation of from 15,000 to 19,000 feet, sinking gradually towards the poles, until it touches the sea-level in the Northern Hemisphere in about latitude 78°. Within the temperate zones 300 feet in elevation is reckoned to be equal to 1° of temperature. The temperature of a place is much affected by its position in regard to the ocean or other large bodies of water, by the nature of the soil, and by the presence or absence of forests, or even of vegetation.

The effect of this latter cause, however, does not consist so much in modifying the general temperature of the whole twenty-four hours, as in affecting its distribution between the day and night. The greatest extremes of diurnal heat and cold are observed in bare, sandy deserts, where a day of intense heat is often followed by a night uncomfortably cold. The influence of forests is directly the reverse. They sensibly lower the temperature during the day, and raise it during the night. Hence the essential difference between the climates of two regions, where the absolute amount of heat is the same, but one of them is covered with vegetation while the other is bare, lies in this, that the heat of the day is more equally distributed over the entire four-and-twenty hours in the former case, and is, therefore, less intense during the hottest part of the day. Close observation evinces the same thing upon a smaller scale. During the warm months of the year the temperature is sensibly lower in a patch of woodland than in the open fields outside of it, and there is consequently a slow but steady outflow of air from the forest; but the reverse happens during the night, when the temperature of the forest is higher than that of the open country, and there is consequently a perceptible inflow of air into the forest. The relations between forests and economic considerations are fully treated in another chapter.

There is a very marked difference between the temperature of the Eastern and Western Continents within the same latitudes and at the same elevation. On the Atlantic shores of the continents the difference in mean temperature is equivalent to about seven degrees of latitude, equal to nearly 500 statute miles. The isothermal line of 59° traverses the parallel of 42° in Europe, but sinks to that of 35° in America. Rome and Boston are in nearly the same latitude (about 42°); but the climate of Rome corresponds to that of Beaufort, N. C., in latitude 34° 41′.

Of more importance to us is the marked difference in the climates of our own Atlantic and Pacific sides in corresponding latitudes. On the Atlantic coast the mean temperature of 52°

occurs in latitude 41°, on the Pacific coast in latitude 48°. In crossing the continent from east to west the isothermal line of 44° of temperature ranges through every degree of latitude between 34° and 45°. This difference is not confined to the opposite coasts, but is notably manifested in passing from the Mississippi westward to the great central plateau at the base of the Rocky Mountains, where the temperature at considerable altitudes is higher than it is at the level of the Atlantic coast in the same latitudes. Fort Benton, on the Upper Missouri, is at the altitude of 2700 feet; but the mean temperature is 10° warmer than at St. John's, Newfoundland, in nearly the same latitude; whereas, by the general rule of altitudes, it should be 9° colder. At Fort Laramie, 4500 feet above the sea, it is warmer by 2° or 3° than at Boston, the latitudes being nearly the same. Denver, 6000 feet above the sea, has the same mean temperature as Baltimore, whereas, the latitude being the same, it should be 20° colder. The extremes of mean annual temperature in the United States occur in Southern Florida and the sandy plains of Arizona, where it rises to 76°, and in Northern Minnesota and Dakota, where it sinks to 36°. But the extreme range between summer and winter temperature is much greater. A summer heat of 118° in the shade has been noted in Arizona, and a winter cold of −25°, or 57° below the freezing point of water, in Maine, and nearly as much in Nebraska. Table XXX. shows the rainfall for each State and Territory, of the whole year, and the hottest summer and the coldest winter month in the year, the numbers being, whenever possible, the average for several successive years.

Rainfall.—A regular and adequate supply of moisture is the prime essential of fertility of the soil. Without this, no matter what else there may be, barrenness is inevitable, and there are very few regions outside of the polar regions which are desert from any other cause than the absence of water. Taking the term rainfall in its widest sense, so as to include snow and fogs, all the fresh water of the globe has rained down from the clouds. There is a prevalent opinion that a gradual diminution is going on in the annual rainfall of the earth. There is, indeed, a very considerable variation in the amount of rainfall from one year to another. There are wet years and dry years, and there seems to be a degree of periodicity in the recurrence of these, and eminent meteorologists have endeavored to show that the seasons run in respect to cycles of about ten years. But accurate observations have been made in Great Britain and the older parts of the United States since 1810, and the recorded results show that, dividing this seventy years into periods of ten years, the annual rainfall does not appreciably differ from decade to decade. During the whole seventy years the difference between the lowest and the highest decade was as 938 to 1068 in the Eastern and Middle States of the Union, and slightly less in Great Britain. The change, moreover, as far as there is any, is by way of increase in the Ohio and Mississippi valleys, and on the Atlantic coast from Maine to Virginia, with a slight decrease on the South Atlantic coast. In California, where the observations go back only to 1850, there appears to be a considerable decrease during the last decade; but it is not improbable that all these apparent variations are to be ascribed to inaccuracies in observation rather than to any permanent change in the general amount of rainfall in the several sections, although there is a considerable difference between the quantity in a dry year and a wet one.

There is a very great difference in the amount of rainfall in different regions. At Cherrapoonjee, among the Ghauts in India, the annual rainfall is 610 inches; at Singapore, 190; at Bombay, 85; at Madras, 45. In France it is 56 inches at Bayonne, and 23 at Paris. In Great Britain it is 50 inches at Galway, 39 at Glasgow, and 24 at London. It is 85 inches at Bergen (Norway), 38 at Milan, 29 at Brussels, 24 at Berlin, 20 at Vienna, 16 at St. Petersburg, 9 at Madrid. In Africa there are 86 inches at Sierra Leone, 27 at Algiers, 24 in the Cape Colony. In America, outside of the United States, we find 153 inches at Balize (Honduras), 90 at Sitka, 54 in British Columbia, 75 at Barbados, 83 at Kingston (Jamaica), 50 at Havana, 59 at Rio Janeiro, 8 at Cumana (Venezuela). In Australasia, there are 46 inches at Sydney, 30 at Melbourne, 20 at Hobart Town, 19 at

Adelaide. In Tahiti and the other Polynesian islands the average is about 45 inches.

In the United States the average rainfall is very different in the different sections. The extremes are 70 or 80 inches upon the upper Pacific slope, down to 12, 8, or even less in the great interior basin lying between the Rocky Mountains and the Sierra Nevada, and portions of Lower California. On the Atlantic slope the range is from 36 to 60 inches, and somewhat less in the Lake region and in the valleys of the Missouri and Upper Mississippi. In those States and Territories the area of which is very large the amount is different in different sections. Table XXX. shows (together with the mean temperature) the average rainfall in the several States and Territories:

TABLE XXX.—MEAN TEMPERATURE AND RAINFALL.

STATES.	Rainfall.	Mean Temperature.			STATES.	Rainfall.	Mean Temperature.		
		Summer.	Winter.	Year.			Summer.	Winter.	Year.
	Inches.	*Deg.*	*Deg.*	*Deg.*		*Inches.*	*Deg.*	*Deg.*	*Deg.*
Alabama	50	82	50	63	Missouri......	32	79	28	55
Arizona	6	85	35	60	Montana Ter...	13	70	11	42
Arkansas.....	48	80	46	62	Nebraska	28	70	22	48
California	21	60	59	56	Nevada.......	..	..	..	..
Colorado	13	74	29	49	New Hampshire	50	68	27	46
Connecticut ...	48	69	30	50	New Jersey ...	44	70	29	52
Dakota.......	50	88	19	54	New Mex. Ter..	20	70	32	51
Delaware	50	79	33	52	New York	42	75	32	48
Florida.......	54	83	53	70	North Carolina.	46	72	38	54
Georgia	62	83	46	66	Ohio	40	76	32	52
Idaho	..	..	..	..	Oregon	39	66	37	50
Illinois	40	77	33	54	Pennsylvania ..	40	75	32	48
Indiana	38	76	31	52	Rhode Island..	42	70	30	50
Iowa.........	44	71	24	48	South Carolina.	41	79	46	63
Kansas.......	45	76	29	53	Tennessee	46	74	38	57
Kentucky.....	50	75	35	55	Texas	35	84	50	68
Louisiana.....	58	82	50	68	Utah Ter.. ...	15	76	27	51
Maine........	42	69	23	44	Vermont	41	68	17	42
Maryland.....	48	79	34	56	Virginia......	45	76	41	58
Massachusetts .	45	71	21	48	Wash. Ter.....	54	63	38	51
Michigan	31	68	27	47	West Virginia .	43	71	31	52
Minnesota	36	75	25	47	Wisconsin	32	72	20	46
Mississippi....	58	84	43	66	Wyoming Ter..	14	72	13	44

Whenever possible, these figures give the average results at different points in the States for a number of years; but in some cases such data are inaccessible, and the figures represent only a single place. Thus, the observations for California were those made at San Francisco; for Texas, at Austin; for Washington

A WINTER RENDEZVOUS.

See Note 44.

Territory, at Steilacoom; for Utah, at Salt Lake City; for New Mexico, at Santa Fé; for Wyoming, at Cheyenne. We find no record of continuous observation for even a single year in Nevada or Arizona; and in no State does the mean temperature indicate the extreme range of the thermometer, which often rises in summer many degrees above the mean, and in winter falls many degrees below the mean range. This is more especially the case in the central basin and in the prairie States of the North-west.

The rainfall in nearly every section is amply sufficient for agricultural purposes if it were properly distributed; but where it falls below twenty inches artificial irrigation is advisable; if it is less than ten inches, irrigation is absolutely indispensable in order to secure any probability of good crops. The periodicity of the rainfall is also a matter to be taken into account. On the Atlantic coast rains occur at all seasons, but in the Southern portions mainly in the summer, and to this fact is to be ascribed the adaptation of the climate to the growth of cotton. On the Pacific coast the rainfall is mainly in the winter, although south of latitude 40° there are autumnal rains. In the region bounded by the Cascade and Sierra Nevada mountains rain in summer is almost unknown, and to this, rather than to any absolute deficiency, is to be ascribed the necessity of irrigation there. This peculiarity is specially noted in the chapter devoted to California. The first thing to be considered by the agriculturist who has it in mind to emigrate to any part of the United States where there is a distinctively dry season, is whether artificial irrigation is practicable. If this cannot be had, the lands, however excellent in other respects, will be comparatively worthless for agricultural purposes, and are suitable only for grazing.

NOTES.

Note 1.

It would be difficult to select a more fitting frontispiece for this book than "The Promised Land," an engraving of a statue by Franklin Simmons, one of our foremost American artists. It expresses the energetic pioneer spirit that has looked over this broad land of ours, and, seizing upon its possibilities, has made the wilderness blossom like the rose.

No feeble purpose is here depicted; but the ardent gaze of one who longs for a wide sphere of activity, and has the keenness of vision to detect the grand opportunities which beckon from the horizon the thoughtful and the vigorous.

Note 2.

The rapid development of the West, and the magnificent scale upon which agricultural operations are carried on, are well shown by these companion engravings—"Ploughing and Sowing," "Harrowing and Reaping." One of the fields in Dakota devoted to wheat-growing contains 13,000 acres, while farms of 6000 acres are quite common.

"A Harvest Scene" in Scotland makes a contrast which is by no means exaggerated.

Note 3.

"Irrigating an Orange Grove" and "Vintage at San Gabriel" illustrate scenes in Southern California so graphically described by Mr. Charles Nordhoff. He states that good crops of both grapes and cereals may be raised there for a series of years; but then a dry year comes, and everything is scorched from the face of the earth. Orange groves must be irrigated every year.

Want of water ruins many a crop in the rest of the United States. Why should not the farmers in all sections turn their thoughts to irrigation? Would not the windmills which now dot every landscape in the North contribute something to the solution of the problem?

Note 4.—*Runners.*

* * * Iroquois was born in America, trained by an American, and had won fame on the American turf before he landed in England. He unfortunately

missed the Two Thousand Guineas, but won the Derby by half a length, and the St. Leger, over a longer course, by a length. The throngs of horse-taming Yorkshiremen who crowd the Town Moor at Doncaster are better judges of genuine sport than the Londoners who make an annual holiday at Epsom, and the welcome they gave to Iroquois was warmer than the ovation accorded to him at Epsom. Iroquois is a brown horse with one white fore-foot, and shows splendid action and staying powers. In both races he enjoyed the benefit of Archer's riding, Lord Falmouth resigning his claim to that jockey's services in the St. Leger. Between these two great events he won the Prince of Wales's Stakes at Ascot, giving nine pounds. The success of Mr. Lorillard's horse is to be attributed in no small degree to his American trainer, Pincas, who, as a well-informed correspondent of the *Spirit of the Times* writes, "took a lame horse from the hands of his predecessor and won the great event of the year." How great a horse Iroquois is, is proved by the fact that since the establishment of the two races only nine double victories have been gained. * * *

Foxhall, by King Alfonso, was born in Kentucky, and was purchased by his fortunate owner for the small sum of $650. He is a dark bay, with black points, and the near hind pastern white. He has a clean head, light neck, a back a trifle too lengthy, but a good barrel, and shoulders of admirable power. He was the first American colt that ever ran in France. The finish for the Grand Prix was magnificent. Archer was riding the French colt Tristan, and as they came along the homestretch rode his very best, and lifted his horse almost even to Foxhall. A shout of "Tristan! Tristan!" was rending the air from thousands of excited Frenchmen, the horses were almost past the Jockey Club stand, when Fordham for the first time raised his whip. A cut on the shoulder of Foxhall is answered by a grand leap forward, and the Grand Prix of Paris, with its 160,000 francs, is won by Mr. Keene.

After his French victory Foxhall performed but poorly at Ascot, and English critics felt inclined to think his triumph at Longchamps a mere accident. They were undeceived by his splendid performances in the great autumn locals. In the Cesarewitch he carried 110 pounds, and won in a common canter; in the Select Stakes, with 127 pounds, he again defeated with the utmost ease his old French rival Tristan; in the Cambridgeshire, with 126 pounds on his back, he defeated Lucy Glitters, carrying 91 pounds, by a head, while Tristan came in third, with 107 pounds. Among the horses not placed by the judge in this last race was the Derby victor of 1880, Bend Or, carrying 134 pounds. In the Champion Stakes, ten days before the Cambridgeshire, Bend Or, with 130 pounds, had defeated Iroquois with only 116 on his back. But we must not rashly infer anything as to the relative merits of the two American horses from these performances, as Iroquois was quite fourteen pounds below his Derby form. Foxhall's double victory in the two great Newmarket handicaps has had only one parallel, the victory of Rosebery in 1876. Mr. Keene may well say that his "colt is the greatest horse in the world." The Cesarewitch course is two miles and a quarter in length, and Foxhall came in ten lengths in front of Chippendale—an exploit of which the greatest horses in the annals of the turf might have been proud. In the Cambridgeshire the finish was closer, but the great stamina of the American enabled him to struggle successfully with his less heavily weighted competitors.

Trotters.

The best trotters that flourished about 1830 could not do a mile under 2.50, but in 1856 Flora Temple reduced the time to 2.24½. In 1866, Woodruff's pride, Dexter, under the saddle, did the mile at Buffalo in 2.18, and in the following year in 2.17¼. Since that time Mr. Bonner's famous Rarus, Goldsmith Maid, Lulu, and others have trotted their mile in 2.15 or less. * * *

If the pedigree of Almont, in the male line, were succinctly stated after Scriptural fashion, it would be somewhat as follows: The Darley Arabian, imported into England in the year 1709, begot Flying Childers, and Flying Childers begot Blaze, and Blaze begot Sampson, and Sampson begot Engineer, and Engineer begot English Mambrino, and English Mambrino begot Messenger (imported into the United States), and Messenger begot Abdallah, and Abdallah begot Rysdyk's Hambletonian, and Rysdyk's Hambletonian begot Alexander's Abdallah, and Alexander's Abdallah begot Almont. The pedigree in the breeder's catalogue, however, follows back his dam and granddam in the same way, the first tracing through the divergent stream of Mambrino Paymaster to the Darley Arabian also, and the second through Alexander's Pilot, Jun., and imported Diomed to the Godolphin Arabian. It traces also each male factor to his first, second, and third dam, and sets down his famous progeny and his time, so that the whole occupies two closely printed duodecimo pages.

Make way! make way! The spirited young stallion Almont Lightning, son of Almont, is led out into the straw-covered aisle. He is good-nature itself, yet it would not be comfortable to be knocked by his heels into the middle of next week, even in play. What power and fire! He is sixteen hands high, dark bay, and has black points extending up to the knees and hocks. * * *

The stallion Aberdeen is a son of Rysdyk's Hambletonian by the star mare Widow Machree. The Widow was one of the gamest mares that ever lived. She would go in any condition of health, and in her greatest race had to be helped to her feet, and "could scarcely put one foot before the other" when she first came on the track. Happy Medium is another son of Rysdyk's Hambletonian, by Princess, the great rival of Flora Temple. Ethan Allen, Jun., represents the hardy Morgan family.

Note 5.

"Sheep Tending" and "A Barn-yard" are both English scenes, introduced by way of contrast, to bring into relief the farm scenes of America. In "Merrie England" an average of twenty-eight bushels of wheat is raised to the acre, and frequently from forty to fifty bushels are obtained. Many of the farms are five and six hundred acres in extent, and the farmers who lease the land (they rarely own it) have a struggling time, and the laborers invariably end their days in the pauper establishments. Relief to laborers is characterized as "their share in the wealth of England." All of this struggling and humiliation go to sustain the grandest nobility on the face of the earth.

NOTE 6.—"*View of Echo Farm Buildings.*" "*Jerseys.*"

This model dairy farm on the sterile soil of Connecticut is conducted on strict business principles by a business man, who, by raising the celebrated "Jersey" stock and using correct methods in all details of management, is enabled to command one dollar a pound for all the butter produced, and get fabulous prices for his animals.

NOTE 7.—"*A Home Lawn.*"

Why do young men grow restive, and chafe to leave the farm? Because the fathers and mothers are too much absorbed in money-making, and forget that the bright and the beautiful appeal more forcibly to the young life than the prudent and the prosaic. What a potent influence a beautiful home exercises over a youth, following him through manhood and finally bringing him back to be gathered to his fathers! Every country home can be made a Paradise without the expenditure of much money. Its grounds, at least, can be embellished in a variety of ways, of which this engraving gives a hint.

NOTE 8.

"The Field Bouquet" shows how profuse nature is in supplying the means of an adornment which attracts the eye, and appeals to the taste quite as much as marbles and bronzes. Such simple bouquets as the one shown in this engraving are always of great value for house decorative purposes, and are always sure to delight the lovers of nature and the invalid, as much as an expensive bouquet of hot-house roses.

NOTE 9.—"*Returning From Work.*"

The artist finds more to depict in rural scenes than among the palaces of the great cities. Let no aspirant for art-honors, living in some obscure locality, think that he has not at hand an abundance of material from which to draw his inspirations.

NOTE 10.

"Turning a River" is a characteristic scene in California, where even the "everlasting hills" give way before the search for gold.

Note 11.

"Old Manner of Working" and "New Manner of Working" show the march of improvement in coal-mining.

Note 12.

"Petroleum Pumping near Oil City" explains itself. May we not ask, while our thoughts rest a moment upon this marvel of these later times, if there is not some other natural product awaiting discovery?

Note 13.—"*Light of the Pyrosoma.*"

Humboldt refers to a spectacle he enjoyed when passing through a zone of fire bodies in the Gulf Stream, saying, "One night among the Florida Keys our party had been drifting over the reef in silent admiration of the scene, when, in a boat in front of us, a singular light suddenly appeared like a halo, surrounding a fair young face, flooding it seemingly with golden radiance. A large pyrosoma had been captured, and its glass prison held aloft in pleasant jest—a living beacon to the more tardy explorers. The brilliancy of this beautiful creature was distinctly visible at a distance of several hundred yards, and that of one five feet in height can well be imagined."

Note 14.—"*Salmon Fishing.*"

This engraving illustrates a scene common in Maine, where the rivers still furnish abundant sport to fishermen, and one that may again become common in rivers where salmon were once abundant, if the Fish Commission receive active co-operation on the part of the people.

Note 15.—"*Avenue of Hemlocks and Spruces.*"

In this engraving we have an effect in landscape gardening within the reach of any one owning a few acres of land. It is in the power of any reader of this book who is engaged in farming not only to contribute his mite to the future health, comfort, and wealth of the country by planting trees, but to add largely to the beauty of his neighborhood by their proper selection and arrangement. Herein is room for the finest artistic perceptions. An authority on this subject declares that a landscape artist who has any proper conception of his task is difficult to find.

Note 16.

"Snaking out Logs" is a scene in the California redwood forests. "Near the end of the log an iron hook called a 'dog' is driven in, where the drag is attached; then six or eight yoke of oxen drag it endwise down the hill. Though the pitches they scramble down are too steep and smooth for us to follow, the oxen stay upon their legs and keep out of the way of the logs. But a single log must be of extraordinary size to content the driver. He frequently chains together two, three, even five or six logs, and starts up the slow-moving cattle with a train behind them four or five rods long."

NOTE 17.—"*Rafts in the Dells.*"

"The Dells" is an irregular gorge some ten miles in length, walled in with sandstone rock from thirty to one hundred feet in height, through which the Wisconsin River flows. The river here swells to a greater width, its broad expanse so smooth that the sky and floating rifts of fleecy clouds are reflected in its surface with such perfection that we seem afloat between hemispheres of light, clasped by a double zone of dark-brown rock and sand, and set in broken bands of green. The rafts will soon cease to add to the picturesqueness of the scene, for the pine forests have but a few more years of existence before them.

NOTE 18.—"*Main Entrance to the Cathedral, Seville.*"

This engraving is inserted for the benefit of readers interested in art and architecture.

NOTE 19.—"*The Gates of Ghiberti.*"

This is a representation of the doors of the Baptistery of Florence, a church twelve hundred years old.

In 1400 these doors in bronze were designed by Lorenzo Ghiberti. When the designs were submitted to the judges, his chief competitor, who divided their opinions, besought them to decide in Ghiberti's favor, as the merit was undoubtedly his. Michael Angelo, standing before them one day, said, "They are so beautiful that they might stand at the gates of Paradise."

A copy in bronze one-half the size of the original was made by Barbedienne of Paris, and sold to Prince Demidoff. At the sale of his collection they were purchased for Mr. William H. Vanderbilt, to grace his residence on Fifth Avenue.

NOTE 20.—"*Columbus Before the Council.*"

This, with seven other panels of the bronze doors of the Capitol at Washington, was executed by Randolph Rogers, one of our talented American artists, who has given to the world many exquisite works indicating fine sentiment and fancy.

A "Carved Decorative Panel" is by T. W. Dewing, an American artist, and is in answer to the demands upon art made by those who are creating beautiful homes.

Note 21.

"Evening" is by E. D. Palmer, of Albany, who has won transatlantic fame by the purity and originality of his art. His exquisite bass-reliefs, in which he has embodied with extreme felicity the domestic sentiments, or the yearnings and aspirations of the Christian soul, are among his best and most widely known productions.

Note 22.—"*Sculpture over Door of St. Hubert's Chapel at Amboise,*" *France.*

This chapel is said to contain the finest fifteenth century art-work in Europe.

Note 23.—"*Souvenir.*"

This drawing was inserted not only as a specimen of the engraver's skill, but because it is an interesting example of the conversion of artistic material to purely decorative uses in illustration. It is one of the most graceful of the many ornamental conceits that Mr. Gibson's fertile pencil has produced.

Note 24.

"The Bay-window in W. K. Vanderbilt's House, Fifty-second Street, R. M. Hunt, Architect," is a specimen of the elaborate decoration which is to adorn the buildings of the future. Heretofore, as compared with Europe, we have but little architecture and feeble art. But both the architect and the artist are in process of evolution, and the genius of each will be found among the young readers of this book.

Note 25.—"*Hall and Staircase.*"

The stiff, unbroken stairs of our primitive dwellings are to give way to elegant constructions like this, which admit of decorative effects otherwise impossible. The "Frieze" also shows the direction of the mural decoration which now replaces the heretofore wearisome and empty areas of even our best interiors.

Note 26.—"*Modern Dwellings.*"

Few residences display the just proportions of Design 1. The original idea was suggested by a design of a villa by M. Aubertin in "Habitations Modernes." In stone or brick, the estimated cost of such a building would be $16,000. It contains fifteen commodious rooms. Design 2 is a good illustration of the prevailing style of architecture. Twelve or thirteen rooms can be constructed in it, and the cost complete would be about $15,000.

NOTE 27.—"*Ebony Cabinet.*"

With this elaborate specimen of wood-carving is seen an "Oak Easel," a "Child's Walnut Chair," and an "Italian Sconce," all interesting to students of Decorative Art. The "Chest in Carved Oak" furnishes an example of antique carving which in some respects is not approached in these days.

NOTE 28.—"*Parlor Decoration.*"

This represents a parlor decorated by Louis C. Tiffany & Co., the foremost decorators of this country. Twenty years hence thousands of decorators will have an ample field for the display of their talents. We trust that some of the readers of this book may be among the foremost.

NOTE 29.

"Trenton and its Potteries" and "Decorating Room" illustrate the beginning of a great industry in this country. Enough has been accomplished to prove that there is in store for America a complete ceramic independence of the countries that now supply her with the finest wares, since she possesses both the inventive genius and unlimited supplies of the best raw materials.

This beautiful "Faience Vase" is one of the most important ones belonging to the collection of Mrs. Colonel T. Scott.

The United States Potters' Association, composed of over fifty firms, has founded an evening School of Design at Trenton, to which those employés may be sent who evince a talent for drawing, modelling, or decoration; thus endeavoring to supply the artistic requirements also.

NOTE 30.

"On a Market-boat in North Holland" is an excellent piece of wood-engraving designed to furnish an example for readers interested in the study of the art.

NOTE 31.—"*St. Cecilia,*" *by Raphael.*

The celebrated painting from which the engraving is taken is in the museum at Bologna. The matchless artist has represented the virgin martyr in an ecstasy listening to celestial music, and letting fall from her hands a little portable organ on which she has begun the concert finished by the angels.

NOTE 32.—"*Jacques Cartier Setting up a Cross at Gaspé.*"

In 1534 Cartier visited Newfoundland and the St. Lawrence, and at Gaspé, in the province of Quebec, near the mouth of the river, erected a cross. The artist and wood-engraver have both succeeded well in this effort to depict a historic scene.

Note 33.

This illustration shows the decorative value of a few old plates. It is not a fancy sketch, but a photographic copy of the fireplace and chimney in a room in an old New England country house. The mantel is of plain wood, in old style, without ornament, and the excellent taste of a lady who loves art has made it brilliant with enamels. We only regret that we cannot give the colors to exhibit the charming effect. The tiles which surround the fireplace are blue-and-white, decorated in quaint old patterns at Delft, except the corners, which are Venetian. Above them hangs a row of five ancient blue-and-white Chinese and Japanese plates of various patterns, all superb in color. On the mantel stand from time to time such ornaments as suit the taste or the mood of the lady. To-day there are two old square bottles of Chinese porcelain, a pair of Sèvres cups of very delicate work, a drug vase of Italian majolica, and two tall vases of German glass, graceful in shape and rich in color. On the wall hang both paintings and plates. The paintings are water-colors, which generally harmonize better than oil-paintings with enamels. None of the plates hanging here are painted with subjects. It is not often that pottery or porcelain with subject paintings can be hung with other paintings. But each of these plates is a gem of color. The lower one of the three in the middle is a wonderful piece of old Japanese splendor, a wild intermingling of every color known to ceramic art, in leaves, flowers, and emblematic designs around the arms, or insignia, of a prince. Above it is a plate of "porcelaine des Indes," which might be mistaken for Lowestoft, and above this a large Delft dish. The plate at the right is by Wedgwood, and (a rare occurrence) on its back is the name of the person for whom the service was made—a New Englander of the last century. There are some very rare and very beautiful ceramic treasures in cabinets on the other sides of the room; but this chimney is important to our purposes, as well as beautiful, for many of the plates are representatives of old services in the family, and all the specimens here visible, including those on the mantel, excepting only the Venetian tiles, were obtained in this country. There is no one specimen which for beauty and decorative effect is not worth much more than its weight in silver.

It is a very easy matter for any one, with patience and taste, thus to make a room brilliant, cheery, and full of bright thoughts. There is probably no New England village, dating its settlement from the last century, which could not furnish material for many such decorations.

Note 34.

"A Sunday Morning in Surrey" is a fine wood-engraving by Hoskin, who ranks among the best wood-engravers of this country. American wood-engravings are now admitted by all critics to be superior to foreign productions. We would here suggest to our readers that first-class wood-engravers are always in demand.

Note 35.—"*A Library Effect.*"

A writer on Decorative Art says, "It is only a few years since the name of an American artist has become commercially valuable. Now that our commercial millionaires have begun to vie with each other as liberal patrons of art, we find the most ambitious undertakings in New York City; and though five years hence the most elaborate efforts of to-day will seem comparatively mere experiments in luxurious splendor, it is hardly five years since a description of them would have sounded to American ears, at least, like fabulous extravagance. Not that the humbler tastes of the æsthetic poor are receiving less attention—on the contrary, our most famous decorators take special pride in such small triumphs over economical restrictions as the accompanying illustration of a small library effect by Mr. Samuel Colman, in which a delicate sense of proportion and of color is made to supply the place of expensive material and workmanship." There is nothing to prevent woman, with her exquisite taste, from filling this promising field of Decorative Art.

Note 36.

"Screens" afford an ample field for the display of the fancy of amateur decorators, and add largely to the elegance of a room. The engraving represents one painted by Princess Helena.

Notes 37 and 38.

"Springtime" and "Art Connoisseurs," drawn by W. H. Gibson, are most beautiful specimens of wood-engraving, and will serve as models for those who wish to excel in the study of that interesting, profitable art.

Note 39.—"*Among the Weeds.*"

What is said of the "Field Bouquet" is equally applicable to this wood-engraving. The delicacy of treatment, however, is greater, and it can be characterized as a far better example of fine work.

Note 40.

"The Lost Lenore" is reduced from one of the engravings in "The Raven," the last work illustrated by the great French artist, Gustave Doré. It follows these lines:

> "Eagerly I wished the morrow; vainly I had sought to borrow
> From my books surcease of sorrow—sorrow for the lost Lenore."

Note 41.

"The Sisters," from a painting by E. A. Abbey, affords another engraving for the study of those ambitious to excel in wood-engraving.

Note 42.

"The Ghost in Hamlet" is by Thomas R. Gould, an American artist who has created some remarkable and beautiful ideal works. In his productions we find a powerful originality, and an attempt to render in marble effects usually left to the higher orders of pictorial art.

Note 43.

"A Cloud Effect on Mount Lafayette, White Mountains," drawn from nature by W. H. Gibson, is interesting to the artist, and at the same time worthy of the attention of the engraver.

Note 44.

"A Winter Rendezvous," by W. H. Gibson, furnishes more material for amateur engravers—those who wish to draw from the storehouse of nature.

APPENDIX.

Various Interesting and Valuable Tables from HASWELL'S *Mechanics and Engineers' Pocket-book: re-written, and enlarged to about* 850 *pages.* 1884. *Harper & Brothers, Publishers, Franklin Square, New York.* (*Nearly Ready.*)

HUMAN AND ANIMAL SUSTENANCE.

Least Quantity of Food required to sustain Life.

	Carbon. Grs.		Nitrogen. Grs.
Adult Man	4300	......	200
Adult Woman	3900	......	180
Mean	4100	.... ..	190

These quantities and proportions are contained in about 2 lbs. 2 oz. ordinary bakers' bread.

A man, for his daily sustenance, requires about 1220 grs. nitrogenous matter, and bread contains 8.1 per cent. of it.

Therefore, 2 lbs. 2 oz. = 14,875 grains × 8.1 = 1205 grains.

Nutritive Values of Food in Grains per Pound.

FOOD.	Carb.	Nitr.	FOOD.	Carb.	Nitr.	FOOD.	Carb.	Nitr.
Beef	1.854	184	Fresh Butter	6.456	—	Rye-meal	2.693	86
Barley-meal	2.563	68	Green Vegetables	420	14	Rice	2.732	68
Bakers' Bread	1.975	88	Green Bacon	5.426	76	Red Herrings	1.435	217
Buttermilk	387	44	Indian-meal	3.016	120	Split Peas	2.698	248
Bullock's Liver	934	204	Lard	4.819	—	Sugar	2.955	—
Beer and Porter	274	1	Molasses	2.395	—	Skimmed Milk	438	43
Carrots	508	14	Mutton	1.900	189	Skim Cheese	1.947	483
Cheddar Cheese	3.344	306	New Milk	599	44	Suet	4.710	—
Cocoa	3.934	140	Oatmeal	2.831	136	Salt Butter	4.585	—
Dry Bacon	5.987	95	Pearl-barley	2.660	91	Turnips	263	13
Fat Pork	4.113	106	Potatoes	769	22	Whey	154	13
Flour, Seconds	2.700	116	Parsnips	554	12	White-fish	871	195

ALIMENTARY PRINCIPLES.

Primary division of Food is into Organic and Inorganic.

Organic is subdivided into Nitrogenous and Non-Nitrogenous; Inorganic is composed of water and various saline principles. The former elements are destined for growth and maintenance of the body, and are termed "plastic elements of nutrition." The latter are designed for undergoing oxidation, and thus become source of heat, and are termed "elements of respiration," or "calorifacient."

Although fat is non-nitrogenous, it is so mixed with nitrogenous matter that it becomes a nutrient as well as a calorifacient.

Alimentary Principles.—1, water; 2, sugar; 3, gum; 4, starch; 5, pectine; 6, acetic acid; 7, alcohol; 8, oil or fat. *Vegetable and Animal.*—9, albumen; 10, fibrine; 11, caseine; 12, gluten; 13, gelatine; 14, chloride of sodium.

These alimentary principles, by their mixture or union, form our ordinary foods, which, by way of distinction, may be denominated *compound aliments;* thus, meat is composed of fibrine, albumen, gelatine, fat, etc.; wheat consists of starch, gluten, sugar, gum, etc.

DIGESTION.

Time required for Digestion of several Articles of Food.—BEAUMONT, M.D.

Food.	Time.	Food.	Time.
	h. m.		*h. m.*
Apple, sweet and mellow	1 50	Heart, animal, fried	4
" sour and mellow	2	Lamb, boiled	2 30
" sour and hard	2 50	Liver, Beef's, boiled	2
Barley, boiled	2	Meat and Vegetables, hashed	2 30
Bean, boiled	2 30	Milk, boiled or fresh	2 2 15
Bean and Green Corn, boiled	3 45	Mutton, roasted	3 15
Beef, roasted rare	3	" broiled or boiled	3
" roasted dry	3 30	Oyster	2 55
" Steak, broiled	3	" roasted	3 15
" boiled	2 45	" stewed	3 30
" boiled, with mustard, etc	3 30	Parsnip, boiled	2 30
" Tendon, boiled	5 30	Pig, sucking, roasted	2 30
" " fried	4	" Feet, soured, boiled	1
" old salted, boiled	4 15	Pork, fat and lean, roasted	5 15
Beet, boiled	3 45	" recently salted, boiled	4 30
Bread, Corn, baked	3 15	" " " fried	4 15
" Wheat, baked, fresh	3 30	" " " broiled	3 15
Butter, melted	3 30	" " " raw	3
Cabbage, crude	2 30	Potato, boiled	3 30
" crude, vinegar	2	" baked	3 20
" crude, vinegar, boiled	4 4 30	" roasted	2 30
Carrot, boiled	3 15	Rice, boiled	1
Cartilage, boiled	4 15	Sago, boiled	1 45
Cheese, old and strong	3 30	Sausage, Pork, broiled	3 20
Chicken, fricasseed	2 45	Soup, Barley	1 30
Custard, baked	2 45	" Beef and Vegetable	4
Duck, roasted	4 4 30	" Chicken	3
		" Mutton or Oyster	3 30
Dumpling, Apple, boiled	3	Sponge-cake, baked	2 30
Egg	2	Suet, Beef, boiled	5 30
" whipped	1 30	" Mutton, boiled	4 30
" boiled hard	3 30	Tapioca, boiled	2
" " soft	3	Tripe, soured	1
" fried	3 30	Turkey, roasted { Wild	2 18
Fish, Cod or Flounder, fried	3 30	Turkey, roasted { Domestic	2 30
" Cod, cured, boiled	2	" boiled	2 25
" Salmon, salted and boiled	4	Turnip, boiled,	3 30
" Trout, boiled or fried	1 30	Veal, roasted	4
Fowl, boiled or roasted	4	" fried	4 50
Goose, roasted	3	" Brain, boiled	1 45
Gelatine, boiled	2 30	Venison Steak, broiled	1 35

Analysis of Different Foods in their Natural Condition.

	Nitrates.	Carbonates.	Phosphates.	Water.		Nitrates.	Carbonates.	Phosphates.	Water.
Apples	5	10	1	84	Milk of cow	5	8	1	86
Barley	17	69.5	3.5	10	Mutton	12.5	40	4.5	43
Beans	24	57.7	3.5	14.8	Oats	17	66.4	3	13.6
Beef	15	30	5	50	Parsnips	9.2	7	1	82.8
Buckwheat	8.6	75.4	1.8	14.2	Pork	10	50	1.5	38.5
Cabbage	4	5	1	90	Potatoes	2.4	22.5	.9	74.2
Chicken	19	3.5	4.5	73	" sweet.	1.5	28.4	2.6	67.5
Corn, Northern	12	73	1	14	Rice	6.5	79.5	.5	13.5
" Southern	35	48	3	14	Turnips	5	4	.5	90.5
Cucumbers	1.5	1	.5	97	Veal	16	16.5	4.5	63
Lamb	11	35.5	3.5	50	Wheat	15	69.2	1.6	14.2

Nitrates—Are that class which supplies waste of muscle.

Carbonates—Are that class which supplies lungs with fuel, and thus furnishes heat to the system, and supplies fat or adipose substances.

Phosphates—Are that class which supplies bones, brains, and nerves, and gives vital power, both muscular and mental.

From above it appears that Southern corn produces most muscle and least fat, and contains enough of phosphates to give vital power to brain, and make bones strong. Mutton is the meat which should be eaten with Southern corn.

The nitrates in all the fine bread which a man can eat will not sustain life beyond fifty days; but others, fed on unbolted flour bread, would continue to thrive for an indefinite period. It is immaterial whether the general quantity of food be reduced too low, or whether either of the muscle-making or heat-producing principles be withdrawn while the other is fully supplied. In either case the effect will be the same. A man will become weak, dwindle away, and die, sooner or later, according to the deficiency; and if food is eaten which is deficient in either principle, the appetite will demand it in quantity till the deficient element is supplied. All food, beyond the amount necessary to supply the principle that is not deficient, is not only wasted, but burdens the system with efforts to dispose of it.

Analysis of Fruits.

Fruit.	Water.	Sugar.	Acid.	Albuminous Substances.	Insoluble Matter.	Pectous Substances.	Ash.
Apple, white	85	7.6	1	.22	1.83	3.88	.47
Apricot, average	83.5	1.8	1.1	.51	4.7	7.55	.84
Blackberry	86.4	4.44	1.19	.51	5.26	1.72	.48
Cherry, red	75.4	13.1	.35	.9	5.83	3.73	.69
" sour	80.5	8.77	1.28	.83	5.91	2.07	.64
" black	79.7	10.7	.56	1	6.04	1.33	.67
Currant, red	85.4	5.6	1.7	.36	3.74	2.4	.8
Gooseberry, red	85.6	8	1.35	.44	2.92	1.26	.43
" yellow	85.4	7	1.2	.46	3.17	2.4	.37
Grape, white	80	13.78	1	.83	2.48	1.44	.47
Peach, Dutch	85	1.58	.61	.46	5.49	6.4	.46
Pear, red	83.5	7.5	.07	.25	3.54	4.8	.34
Plum, yellow gage	80.8	2.96	.96	.48	3.98	10.48	.34
" large "	79.7	3.4	.87	.4	3.91	11.3	.42
" black blue	88.7	2	1.27	.4	6.86	.23	.54
" " red	85.3	2.25	1.33	.43	4.23	5.85	.61
" Italian, sweet	81.3	6.73	.84	.83	4.01	5.63	.66
Raspberry, wild	83.9	3.6	2	.55	8.37	1.28	.4
Strawberry, "	87	4	1.5	.6	5.5	.4	1
Banana	73.9	Sugar, Pectin, Salt, Acid, etc., 26.1.					

HORSE.

Amount of Labor a Horse of average Strength is capable of performing, at different Velocities, on Canal, Railroad, and Turnpike. (Traction estimated at 83.3 lbs.)

Velocity per Hour.	Duration of Work.	Useful Effect, drawn 1 Mile.			Velocity per Hour.	Duration of Work.	Useful Effect, drawn 1 Mile.		
		On a Canal.	On a Railroad.	On a Turnpike.			On a Canal.	On a Railroad.	On a Turnpike.
Miles.	*Hours.*	*Tons.*	*Tons.*	*Tons.*	*Miles.*	*Hours.*	*Tons.*	*Tons.*	*Tons.*
2.5	11.5	520	115	14	6	2	30	48	6
3	8	243	92	12	7	1.5	19	41	5.1
4	4.5	102	72	9	8	1.125	12.8	36	4.5
5	2.9	52	57	7.2	10	.75	6.6	28.8	3.6

Actual labor performed by horses is greater, but they are injured by it.

Tractive Power of a horse decreases as his speed is increased, and within limits of low speed, or up to 4 miles per hour, it decreases nearly in an inverse ratio.

A horse can travel 400 yards at a walk in 4½ minutes, at a trot in 2 minutes, and at a gallop in 1 minute. He occupies in the ranks a front of 40 inches and a depth of 10 feet; in a stall, from $3\frac{1}{2}$ to $4\frac{1}{2}$ feet front; and at a picket, 3 feet by 9; and his average weight = 1000 lbs.

A horse, carrying a soldier and his equipments (225 lbs.), can travel 25 miles in a day (8 hours).

A draught-horse can draw 1600 lbs. 23 miles a day, weight of carriage included.

The ordinary work of a horse may be stated at 22,500 lbs., raised 1 foot in a minute, for 8 hours a day.

In a horse-mill a horse moves at the rate of 3 feet in a second. The diameter of the track should not be less than 25 feet.

A horse-power in machinery is estimated at 33,000 lbs., raised 1 foot in a minute; but, as a horse can exert that force but 6 hours a day, one machinery horse-power is equivalent to that of $4\frac{1}{2}$ horses.

The expense of conveying goods at 3 miles per hour per horse teams being 1, the expense at $4\frac{1}{2}$ miles will be 1.33, and so on—the expense being doubled when the speed is $5\frac{1}{8}$ miles per hour.

The strength of a horse is equivalent to that of 5 men.

The daily allowance of water for a horse should be 4 gallons.

Hauling Stone.—A cart drawn by horses over an ordinary road will travel 1.1 miles per hour of trip.

A four-horse team will haul from 25 to 36 cubic feet of limestone at each load.

The time expended in loading, unloading, etc., including delays, averages 35 minutes per trip. The cost of loading and unloading a cart, using a horse-crane at the quarry and unloading by hand, when labor is $1.25 per day, and a horse 75 cents, is 25 cents per perch = 24.75 cubic feet.

The work done by an animal is greatest when the velocity with which he moves is $\frac{1}{6}$ of the greatest with which he can move when not impeded, and the force then exerted .45 of the utmost force the animal can exert at a dead pull.

Labor upon Embankments.—ELLWOOD MORRIS.

Single Horse and Cart.—A horse with a loaded dirt-cart, employed in excavation and embankment, will make 100 lineal feet of trip, or 200 feet in distance per minute, while moving. The time lost in loading, dumping, awaiting, etc. = 4 minutes per load.

A medium laborer will load with a cart in 10 hours, of the following earths, measured in the bank:

Gravelly Earth, 10; *Loam,* 12; and *Sandy Earth,* 14 cubic yards.

Earth from a natural excavation occupies $\frac{1}{5}$ more space than when transported to an embankment.

Carts are loaded as follows: *Descending Hauling,* $\frac{1}{3}$ of a cubic yard in bank; *Level Hauling,* $\frac{2}{7}$ of a cubic yard in bank; *Ascending Hauling,* $\frac{1}{4}$ of a cubic yard in bank.

Loosening, etc.—In *Loam,* a three-horse plough will loosen from 250 to 800 cubic yards per day of 10 hours.

The cost of loosening earth to be loaded will be from 1 to 8 cents per cubic yard when wages are 105 cents per day.

The cost of trimming and bossing is about 2 cents per cubic yard.

Scooping.—A scoop-load will measure $\frac{1}{10}$ of a cubic yard, measured in excavation.

The time lost in loading, unloading, and turning, per load, is $1\frac{1}{3}$ minutes.

The time lost for every 70 feet of distance, from excavation to bank, and returning, is 1 minute.

In *Double Scooping,* the time lost in loading, turning, etc., will be 1 minute; and in *Single Scooping* it will be $1\frac{1}{3}$ minutes.

MEN.

Mean effect of power of men working to best practicable advantage is raising of 70 lbs. 1 foot high in a second for 10 hours per day = 4200 foot-pounds per minute.

Windlass.—Two men, working at a windlass at right-angles to each other, can raise 70 lbs. more easily than one man can 30 lbs.

Labor.—A man of ordinary strength can exert a force of 30 lbs. for 10 hours in a day, with a velocity of 2.5 feet in a second = 4500 lbs. raised one foot in a minute = .2 of work of a horse.

A man can travel without a load, on level ground, during 8.5 hours a day, at the rate of 3.7 miles an hour, or 31.25 miles a day. He can carry 111 lbs. 11 miles in a day. Daily allowance of water, 1 gallon for all purposes; and he requires from 220 to 240 cube feet of fresh air per hour.

A porter going short distances, and returning unloaded, can carry 135 lbs. 7 miles a day, or he can transport, in a wheelbarrow, 150 lbs. 10 miles in a day.

Crane.—The maximum power of a man at a crane, as determined by Mr. Field, for constant operation, is 15 lbs., exclusive of frictional resistance, which, at a velocity of 220 feet per minute = 3300 foot-pounds, and when exerted for a period of 2.5 minutes was 17.329 foot-pounds per minute.

Pile-driving.—G. B. Bruce states that, in average work at a pile-driver, a laborer, for 10 hours, exerts a force of 16 lbs. plus resistance of gearing, and at a velocity of 270 feet per minute, making one blow every four minutes.

Rowing.—A man rowing a boat 1 mile in 7 minutes performs the labor of 6 fully worked laborers at ordinary occupations of 10 hours per day.

Drawing or Pushing.—A man drawing a boat in a canal can transport 110,000 lbs. for a distance of 7 miles, and produce 156 times the effect of a man weighing 154 lbs. and walking 31.25 miles in a day; and he can push on a horizontal plane 20 lbs. with a velocity of 2 feet per second for 10 hours per day.

Tread-mill.—A man either inside or outside of a tread-mill can raise 30 lbs. at a velocity of 1.3 feet per second for 10 hours = 1,404,000 foot-pounds.

Pulley.—A man can raise by a single pulley 36 lbs. with a velocity of .8 of a foot per second for 10 hours.

Walking.—A man can pass over 12.5 times the space horizontally that he can vertically, and, according to J. Robison, by walking in alternate directions upon a platform supported on a fulcrum in its centre, he can, weighing 165 lbs., produce an effect of 3,984,000 foot-pounds for 10 hours per day.

Pump, Crank, Bell, and Rowing.—Mr. Buchanan ascertained that, in working a pump, turning a crank, ringing a bell, and rowing a boat, the effective power of a man is as the numbers 100, 167, 227, and 248.

Pumping.—A practised laborer can raise, during 10 hours, 1,000,000 lbs. of water 1 foot in height with a properly designed and constructed pump.

Crank.—A man can exert on the handle of a screw-jack of 11 inches radius for a short period a force of 25 lbs., and continuously 15 lbs.; a net power of 20 lbs. Mr. J. Field's tests gave 11.5 lbs. as easily attained, 17.3 as difficult, and 27.6 with great difficulty.

Mowing.—A man can mow an acre of grass in 1 day.

Reaping.—A man can reap an acre of wheat in 2 days.

Ploughing.—A man and horse .8 of an acre per day.

Day's Work.—D. K. Clark.

Laborer.—Carrying bricks or tiles, net load 106 lbs. = 600 lbs. 1 mile.

Carrying coal in a mine, net load 95 to 115 lbs. = 342 lbs. 1 mile.

Loading coke into a wagon, net load 100 lbs. = 270 lbs. 1 mile.

Loading a boat with coal, net load 190 lbs. = 1230 lbs. 1 mile, or 20 cube yards of earth in a wagon.

Digging stubble-land .055 of an acre per day, or 2000 cube feet of superficial earth.

Breaking 1.5 cube yards hard stone into 2-inch cubes.

Quarrying.—A man can quarry from 5 to 8 tons of rock per day.

A foot-soldier travels in 1 minute, in common time, 90 steps = 70 yards.

He occupies in ranks a front of 20 inches, and a depth of 13, without a knapsack; interval between the ranks is 13 inches.

Average weight of men 150 pounds each, and five men can stand in a space of 1 square yard.

CRUSHING STRENGTH.

The *Crushing Strength* of any body is in proportion to the area of its section, and inversely as its height.

In tapered columns the strength is determined by the least diameter.

Crushing Strength of various Materials, deduced from the Experiments of Maj. Wade, Hodgkinson, and Capt. Meigs, U. S. A. (Reduced to a uniform Measure of One Square Inch.)

Figures and Material.	Crushing Weight.
	Lbs.
Cast Iron.	
American, gun-metal	174,803
“ mean	129,000
English, Low Moor, No. 1	62,450
“ “ No. 2	92,330
“ Clyde, No. 3	106,039
“ Stirling, mean of all	122,395
“ “ extreme	134,400
Wrought Iron.	
American	127,720
“ mean	83,500
English	65,200 40,000
Various Metals.	
Fine brass	164,800
Cast copper	117,000
Cast steel	295,000
Cast tin	15,500
Lead	7,730
Woods.	
Ash	6,663
Beech	6,963
Birch	7,969
Box	10,513
Cedar, red	5,968
Chestnut	5,350
Elm	6,831
Hickory, white	8,925
Locust	9,113
Mahogany, Spanish	8,198
Maple	8,150
Oak, American white	6,100
“ Canadian white	5,982
“ “ live	6,850
“ English	9,500 6,484
Pine, pitch	8,947
“ white	5,775
“ yellow	8,200
Spruce, white	5,050
Sycamore	7,082
Teak	12,100
Walnut	6,645
Stones, Cements, etc.	
Brick, machine-pressed	6,222 14,216
Brick, common	4,000 800
Clay, fine, baked	175
“ “ rolled and baked	400
Common brick masonry	800 500
Crown-glass	31,000
Craigleith Limestone, English	7,300 2,185
Aberdeen granite “	8,400 10,363
Arbroath “	7,884
Caithness “	6,493
Limestone “	3,065
Portland “	15,583 4,570
Portland cement “	15,000
“ mean “	8,300
Portland oolite “	3,850
Fire-brick, Stourbridge	1,717
Freestone, Belleville	3,522
“ Caen	1,088
“ Connecticut	3,319
“ Dorchester	3,069
“ Little Falls	2,991
Gneiss	19,600
Granite, Patapsco	5,340
“ Quincy	15,300
Marble, Baltimore, large	8,057
“ “ small	18,061
“ East Chester	13,917
“ Hastings, N. Y.	18,941
“ Italian	12,624
“ Lee, Mass.	22,702
“ Montgomery Co., Pa.	8,950
“ Stockbridge	10,382
“ Symington, large	11,156
“ “ fine crystal	18,248
“ “ strata horizontal	10,124
“ “ strata vertical	9,324
Mortar, good	240
“ common	120
Normandy Caen	1,543
Portland cement 1, sand 1	1,280
Roman “	342
Sandstone, Adelaide	2,800
“ Aquia Creek	5,340
“ Seneca	10,762
Stock brick	2,177
Sydney “	2,228

Strength of Ice.

Thickness: 2 inches will bear infantry; 4 inches will bear cavalry or light guns; 6 inches will bear heavy field-guns; 8 inches will bear, upon sledges, a weight not exceeding 1000 lbs. per square foot.

TENSILE STRENGTH OF MATERIALS.

Weight or Power required to Tear asunder one Square Inch.

METALS.

	Lbs.		Lbs.
Copper, wrought	34,000	Iron, plates, mean, English	51,000
" rolled	36,000	" " lengthwise	53,800
" cast, American	42,250	" " crosswise	48,800
" wire	61,200	" inferior, bar	30,000
" bolt	36,800	" wire, American	73,600
Iron, cast, Low Moor, No. 2	14,076	" " " 16 diam.	80,000
" Clyde, No. 1	16,125	" scrap	53,400
" " No. 3	23,468	Lead, cast	1,800
" Calder, No. 1	13,735	" milled	3,320
" Stirling, mean	25,764	" wire	2,580
" mean of American	31,829	Platinum, wire	53,000
" mean * of English	19,484	Silver, cast	40,000
" Greenwood, American	45,970	Steel, cast, maximum	142,000
" gun-metal, mean	37,232	" " mean	88,657
" wrought wire	103,000	" blistered, soft	133,000 104,000
" best Swedish bar	72,000		
" Russian bar	59,500	" shear	124,000
" English bar	56,000	" chrome, mean	170,980
" rivets, American	53,300	" puddled, extreme	173,817
" bolts	52,250	" American Tool Company	179,980
" hammered	53,913	" plates, lengthwise	96,300
" mean of English	53,900	" " crosswise	93,700
" rivets, English	65,000	" razor	150,000
" crank shaft	44,750	Tin, cast, block	5,000
" turnings	55,800	" Banca	2,122
" plates, boiler, American	48,000 62,000	Zinc	3,500
		" sheet	16,000

Lake Superior and Iron Mountain charcoal bloom iron has resisted 90,000 lbs. per square inch.

COMPOSITIONS.

	Lbs.		Lbs.
Gold 5, Copper 1	50,000	Copper 10, Tin 1	32,000
Brass	42,000	" 8, " 1, gun-metal	30,000
" yellow	18,000	" 8, " 1, small bars	50,000
Bronze, least	17,698	Tin 10, Antimony 1	11,000
" greatest	56,788	Yellow metal	48,700

WOODS.

	Lbs.		Lbs.
Ash	14,000	Maple	10,500
Beech	11,500	Oak, American white	11,500
Box	20,000	" English	10,000
Bay	14,000	" seasoned	13,600
Cedar	11,400	" African	14,500
Chestnut, sweet	10,500	Pear	9,800
Cypress	6,000	Pine, pitch	12,000
Deal, Christiania	12,400	" larch	9,500
Elm	13,400	" American white	11,800
Lance	23,000	Poplar	7,000
Lignumvitæ	11,800	Spruce, white	10,290
Locust	20,500	Sycamore	13,000
Mahogany	21,000	Teak	14,000
" Spanish	12,000	Walnut	7,800
" "	8,000	Willow	13,000

* By Commissioners, on application of iron to railway structures.

MISCELLANEOUS SUBSTANCES.

	Lbs.		Lbs.
Brick, well burned	750	Limestone	670 2,800
" fire	65	Marble, Italian	5,200
" inferior	290 100	" white	9,000
Cement, blue-stone	77	Mortar, 12 years old	60
" hydraulic	234	Plaster of Paris	72
" Harwich	30	Rope, Manila	9,000
" Portland, 6 mos.	414	" hemp, tarred	15,000
" Sheppy	24	" wire	37,000
" Portland 1, sand 3	380	Sandstone, fine grain	200
Chalk	118	Slate	12,000
Glass, crown	2,346	Stone, Bath	352
Gutta-percha	3,500	" Craigleith	400
Hydraulic lime	140	" Hailes	360
" " mortar	140	" Portland	857 1,000
Ivory	16,000	Whalebone	7,600
Leather belts	330		

WEIGHTS OF VARIOUS SUBSTANCES.

Weights and Volumes of various Substances in Ordinary Use.

Substances.	Cube Foot.	Cube Inch.
	Lbs.	*Lbs.*
Metals.		
Brass { copper 67, zinc 33 }	488.75	.2829
" gun-metal	543.75	.3147
" sheets	513.6	.297
" wire	524.16	.3033
Copper, cast	547.25	.3179
" plates	543.625	.3167
Iron, cast	450.437	.2607
" gun-metal	466.5	.27
" heavy forging	479.5	.2775
" plates	481.5	.2787
" wrought bars	486.75	.2816
Lead, cast	709.5	.4106
" rolled	711.75	.4119
Mercury, 60°	848.7487	.491174
Steel, plates	487.75	.2823
" soft	489.562	.2833
Tin	455.687	.2637
Zinc, cast	428.812	.2482
" rolled	449.437	.2601
Woods.		Cube Feet in a Ton.
Ash	52.812	42.414
Bay	51.375	43.601
Blue Gum	64.3	34.837
Cork	15	149.333
Cedar	35.062	63.886
Chestnut	38.125	58.754
Hickory, pig-nut	49.5	45.252
" shell-bark	43.125	51.942
Lignumvitæ	83.312	26.886
Logwood	57.062	39.255
Mahogany, Honduras	35 66.437	64 33.714
Oak, Canadian	54.5	41.101
" English	58.25	38.455
" live, seasoned	66.75	33.558
" white, dry	53.75	41.674
" " upland	42.937	52.169
Pine, pitch	41.25	54.303
" red	36.875	60.745
" white	34.625	64.693
" well-seasoned	29.562	75.773
" yellow	33.812	66.248

Substances.	Cube Foot.	Cube Feet in a Ton.
	Lbs.	
Woods.		
Spruce	31.25	71.68
Walnut, black, dry	31.25	71.68
Willow	36.562	61.265
" dry	30.375	73.744
Miscellaneous.		
Air	.075291	....
Basalt, mean	175	12.8
Brick, fire	137.562	16.284
" mean	102	21.961
Coal, anthracite	89.75 102.5	24.958 21.854
" bituminous, mean	80	28
" Cannel	94.875	23.609
" Cumberland	84.687	26.451
" Welsh, mean	81.25	27.569
Coke	62.5	35.84
Cotton, bale, mean	14.5	154.48
" " pressed	20 25	114 89.6
Earth, clay	120.625	18.569
" common soil	137.125	16.335
" " gravel	109.312	20.49
" dry, sand	120	18.667
" loose	93.75	23.893
" moist, sand	128.125	17.482
" mould	128.125	17.482
" mud	101.875	21.987
" with gravel	126.25	17.742
Granite, Quincy	165.75	13.514
" Susquehanna	169	13.254
Gypsum	135.5	16.531
Hay, bale	12	186.66
" hard pressed	25	89.6
Ice, at 32°	57.5	38.95
India-rubber	56.437	39.69
" vulcanized	....	....
Limestone	197.25	11.355
Marble, mean	167.875	13.343
Mortar, dry, mean	97.98	22.862
Plaster of Paris	73.5	30.476
Water, rain	62.5	35.84
" salt	64.312	34.83
" at 62°	62.355	35.955

BRICKS.

Variations in dimensions by various manufacturers, and different degrees of intensity of their burning, render a table of exact dimensions of different manufactures and classes of bricks altogether impracticable.

As an exponent, however, of the ranges of their dimensions, following averages are given:

Description.	Ins.	Description.	Ins.
Baltimore front...	8.25 × 4.125 × 2.375	Maine.............	7.5 × 3.375 × 2.375
Philadelphia " ...	8.25 × 4.125 × 2.375	Milwaukee.........	8.5 × 4.125 × 2.375
Wilmington " ...	8.25 × 4.125 × 2.375	North River.......	8 × 3.5 × 2.25
Croton " ...	8.5 × 4 × 2.25	Ordinary..........	7.75 × 3.625 × 2.25
Colabaugh	8.25 × 3.625 × 2.375		8 × 4.125 × 2.5
English ordinary..	9 × 4.5 × 2.5	Stourbridge fire-brick..........	9.125 × 4.625 × 2.375
" Lond. stock	8.75 × 4.25 × 2.5		
Dutch clinker.....	6.25 × 3 × 1.5	American do., N.Y.	8.875 × 4.5 × 2.625

In consequence of the variations in dimensions of bricks, and thickness of the layer of mortar or cement in which they may be laid, it is also impracticable to give any rule of general application for volume of laid brickwork. It becomes necessary, therefore, when it is required to ascertain the volume of bricks in masonry, to proceed as follows:

To Compute Volume of Bricks, and Number in a Cube Foot of Masonry.

RULE.—To face dimensions of particular bricks used, add one-half thickness of the mortar or cement in which they are laid, and compute the area; divide width of wall by number of bricks of which it is composed; multiply this area by quotient thus obtained, and product will give volume of the mass of a brick and its mortar in inches.

Divide 1728 by this volume, and quotient will give number of bricks in a cube foot.

EXAMPLE.—Width of a wall is to be 12.75 inches, and front of it laid with Philadelphia bricks in courses .25 of an inch in depth; how many bricks will there be in face and backing in a cube foot?

Philadelphia front brick, 8.25 × 2.375 inches face.

$$8.25 + \overline{.25 \times 2 \div 2} = 8.25 + .25 = 8.5 = \textit{length of brick and joint};$$

$$2.375 + \overline{.25 \times 2 \div 2} = 2.375 + .25 = 2.625 = \textit{width of brick and joint}.$$

Then 8.5 × 3.625 = 22.3125 *ins. = area of face;* 12.75 ÷ 3 (*number of bricks in width of wall*) = 4.25 *ins.*

Hence 22.3125 × 4.25 = 94.83 *cube ins.;* and 1728 ÷ 94.83 = 18.22 *bricks.*

LIME AND LATHS.

A Cask of Lime = 240 lbs., will make from 7.8 to 8.15 cubic feet of stiff paste.

A Cask of Cement = 300 lbs., will make from 3.7 to 3.75 cubic feet of stiff paste.

Laths are $1\frac{1}{4}$ to $1\frac{1}{2}$ inches by four feet in length, are usually set $\frac{1}{4}$ of an inch apart, and a bundle contains 100.

Estimate of Materials and Labor for 100 *Square Yards of Lath and Plaster.*

Materials and Labor.	Three Coats Hard Finish.	Two Coats Slipped.	Materials and Labor.	Three Coats Hard Finish.	Two Coats Slipped.
Lime..........	4 casks.	$3\frac{1}{2}$ casks.	White sand....	$2\frac{1}{2}$ bushels.	....
Lump lime....	$\frac{2}{3}$ "	....	Nails..........	13 lbs.	13 lbs.
Plaster of Paris	$\frac{1}{2}$ "	....	Masons........	4 days.	$3\frac{1}{2}$ days.
Laths..........	2000	2000	Laborer.......	3 "	2 "
Hair...........	4 bushels.	3 bushels.	Cartage........	1 "	$\frac{3}{4}$ "
Sand..........	7 loads.	6 loads.			

CAPACITY OF CISTERN IN GALLONS.

For each 10 *Inches in Depth.*

Diam.	Gallons.	Diam.	Gallons.	Diam.	Gallons.	Diam.	Gallons.	Diam.	Gallons.
Feet.		*Feet.*		*Feet.*		*Feet.*		*Feet.*	
2.	19.5	4.5	99.14	7.	239.88	9.5	441.4	14.	959.6
2.5	30.6	5.	122.4	7.5	275.4	10.	489.6	15.	1101.6
3.	44.07	5.5	148.1	8.	313.33	11.	592.4	20.	1958.4
3.5	59.97	6.	176.25	8.5	353.72	12.	705.	25.	3059.9
4.	78.33	6.5	206.85	9.	396.56	13.	827.4	30.	4406.4

SLATES AND SLATING.

A *Square* of Slate or Slating is 100 superficial feet.

Gauge is distance between the courses of the slates.

Lap is distance which each slate overlaps the slate lengthwise next but one below it, and it varies from 2 to 4 inches. Standard is assumed to be 3 inches.

Margin is width of course exposed, or distance between tails of the slates.

Pitch of a slate roof should not be less than 1 inch in height to 4 of length.

To Compute Surface of a Slate when laid, and Number of Squares of Slating.

RULE.—Subtract lap from length of slate, and half remainder will give length of surface exposed, which, when multiplied by width of slate, will give surface required.

Divide 14,400 (area of a square in inches) by surface thus obtained, and quotient will give number of slates required for a square.

EXAMPLE.—A slate is 24 × 12 inches, and lap is 3 inches; what will be number required for a square.

$24 - 3 = 21$, and $21 \div 2 = 10.5$, which $\times\ 12 = 126$ *inches;* and $14{,}400 \div 126 = 114.29$ *slates.*

Dimensions of Slates.

AMERICAN.

Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
14×7	14×10	16×10	18×11	20×11	22×12	24×13
14×8	16× 8	18× 9	18×12	20×12	22×13	24×14
14×9	16× 9	18×10	20×10	22×11	24×12	24×16

ENGLISH.

	Inches.		Inches.		Inches.
Doubles	13×10	Ladies	12× 8	Marchioness	22×22
"	13× 7	Ladies	14× 8	Duchess	24×12
Small doubles	11× 6	Ladies	14×12	Imperial	30×24
"	10× 5	Ladies	15× 8	Rags	36×24
Plantations	12×10	Ladies	16× 8	Queens	36×24
Plantations	13×10	Ladies	16×10	Empress	26×15
Viscountess	18×10	Countess	20×10	Princess	24×14

Thickness of slates ranges from .125 to .3125 of an inch, and their weight varies from 2 to 4.53 lbs. per square foot.

EXPANSION AND CONTRACTION OF BUILDING STONES.

Expansion or Contraction for each Degree of Temperature.—Lieut. W. H. C. BARTLETT, U. S. E.

	For One Inch.		For One Inch.
Granite	.000004825	Sandstone	.000009532
Marble	.000005668	White-pine	.00000255

ZINC—SHEETS.

Thickness and Weight per Square Foot.

Inch.	Inch.	Inch.
.0311 = 10 oz.	.0534 = 14 oz.	.0686 = 18 oz.
.0457 = 12 oz.	.0611 = 16 oz.	.0761 = 20 oz.

WINDOW GLASS.

Thickness and Weight per Square Foot.

No.	Thickness.	Weight.	No.	Thickness.	Weight.	No.	Thickness.	Weight.
	Inch.	*Oz.*		*Inch.*	*Oz.*		*Inch.*	*Oz.*
12	.059	12	17	.083	17	26	.125	26
13	.063	13	19	.091	19	32	.154	32
15	.071	15	21	.1	21	36	.167	36
16	.077	16	24	.111	24	42	.2	42

WEIGHT OF CATTLE.

To Compute Dressed Weight of Cattle.

RULE.—*Measure as follows in feet:*

1. Girth close behind shoulders; that is, over crop and under plate, immediately behind elbow.

2. Length from point between neck and body, or vertically above junction of cervical and dorsal processes of spine, along back to bone at tail, and in a vertical line with rump.

Then multiply square of girth in feet by length, and multiply product by factors in following table, and quotient will give dressed weight of quarters.

CONDITION.	Heifer, Steer, or Bullock.	Bull.	CONDITION.	Heifer, Steer, or Bullock.	Bull.
Half fat	3.15	3.36	Very prime fat	3.64	3.85
Moderate fat	3.36	3.5	Extra fat	3.78	4.06
Prime fat	3.5	3.64			

ILLUSTRATION.—Girth of a prime fat bullock is 7 feet 2 inches, and length measured as above 4 feet 5 inches.

$7' \; 2'' = 7.17$, and $7.17^2 = 51.4$, which $\times \; 4' \; 5''$ and by $3.5 = 794.5$ *lbs.* Exact weight was 799 *lbs.*

NOTE.—1. Quarters of a beef exceed by a little half weight of living animal.
2. Hide weighs about an eighteenth part, and tallow a twelfth part of animal.

Transportation of Horses and Cattle.

Space required on board of a Marine Transport is: for horses, 30 inches by 9 feet; beeves, 32 inches by 9 feet. Provender required *per diem* is: for horses, hay, 15 pounds; oats, 6 quarts; water, 4 gallons. Beeves, hay, 18 pounds; water, 6 gallons.

Proportion of Food Appropriated and Expended by following Animals.

	Oxen.	Sheep.	Swine.
Proportion appropriated	6.2	8	17.6
" in manure	36.5	31.9	16.9
" respired	57.3	60.1	65.5
	100	100	100

HAY.

550 cubic feet of new meadow-hay, and 440 and 500 from large or old stacks, will weigh a ton.

577 to 604 cubic feet of dry clover weigh a ton.

Hay and Straw.

Hay, loose, 5 lbs. per cube foot. Ordinarily pressed, as in a stack or mow, 8 lbs. Close pressed, as in a bale, 12 to 14 lbs.

Ordinarily pressed, as in a wagon-load, 450 to 500 cube feet will weigh a ton.

Straw in a bale 10 to 12 lbs. per cube foot.

HILLS IN AN AREA OF AN ACRE.

Feet apart.	No.	Feet apart.	No.	Feet apart.	No.	Feet apart.	No.
1	43,560	5	1,742	9	538	16	171
1½	19,360	5½	1,440	9½	482	17	151
2	10,890	6	1,210	10	435	18	135
2½	6,969	6½	1,031	10½	361	20	108
3	4,840	7	889	12	302	25	69
3½	3,556	7½	775	13	258	30	48
4	2,722	8	680	14	223	35	35
4½	2,151	8½	692	15	193	40	27

NUTRITIOUS PROPERTIES OF DIFFERENT VEGETABLES AND OIL-CAKE, COMPARED WITH EACH OTHER IN QUANTITIES.

Oil-cake	1.	Bran, wheat	2.75 and 3.	Old Potatoes	20.
Pease and Beans	1.5	Corn	3.	Carrots	17.5
Rice	1.6	Barley	3.	Cabbages	18.
Wheat, grain	2.5	Pea straw	3.	Wheat straw	26.
" flour	2.	Clover hay	4.	Barley "	26.
Oats	2.5	Hay	5.	Oat "	27.5
Rye	2.5	Potatoes	14.	Turnips	30.

ILLUSTRATION—1 lb. of oil-cake is equal to 18 pounds of cabbage.

RELATIVE VALUE OF FOODS COMPARED WITH 100 POUNDS OF GOOD HAY.

	Lbs.		Lbs.		Lbs.
Clover, green	400	Corn-stalks, dried	400	Oats	57
Corn, green	275	Carrots	276	Corn	59
Wheat straw	374	Rye	54	Sunflower seeds	62
Rye straw	442	Wheat	45	Linseed cake	69
Oat straw	195	Barley	54	Wheat bran	105

MANURES.

Relative Fertilizing Properties of Various Manures.

Peruvian Guano	1.	Horse	.048	Farm-yard	.0298
Human, mixed	.069	Swine	.044	Cow	.0259

Or, 1 lb. guano = 14½ human, 21 horse, 22½ swine, 33½ farm-yard, and 38½ cow.

CONSUMPTION OF ATMOSPHERIC AIR.—COATHUPE.

The average daily volume of carbonic acid gas given off by the respiration of an adult human being amounts to 4.08 per cent. of the air respired.

In 24 hours the respiration of one healthy adult produces 10.7 cubic feet of carbonic acid gas, and removes from the atmosphere exactly the same volume of oxygen.

One wax-candle (three in a pound) destroys, during its combustion, as much oxygen per hour as the respiration of one adult.

The total volume of air that can be required for the respiration of an adult human being in 24 hours, even if no portion of that which has been once respired were to be inspired again, does not exceed 266.7 cubic feet.

A lighted taper, when confined within a given volume of atmospheric air, will become extinguished as soon as it has converted 3 per cent. of the given volume of air into carbonic acid.

Air and Ventilation.

An average-sized man will exhale from his lungs and body from .6 to .7 of a cubic foot of carbonic acid per hour. A lighted oil-lamp or two candles will furnish the same volume.

Assuming, then, that there are 4 volumes of carbonic acid in 10,000 volumes of air, and that a man in a room with a lighted lamp or two candles furnishes from 1.2 to 1.4 cubic feet of acid per hour, there will be required to maintain the air at the required condition for health for one man, the allowable pollution of it being 6 volumes in 10,000, fully 3000 cubic feet of fresh air. By experiments made in Paris it was shown that there was required from 2400 to 3120 cubic feet per hour.

Result of Observations of the Vitiation of the Air.—ANGUS SMITH, M.D.

Atmosphere	3.2 to 3.4	Theatres, average	8. to 32
City Parks	3.2 to 3.8	Offices, "	17. to 22
" Streets	3.8 to 4.4	Workshops, "	20. to 30
" " in a fog	6. to 6.8	Mines, "	78. to 250

EFFECT UPON VARIOUS BODIES BY HEAT.

Wedgwood's zero is 1077° of Fahrenheit, and each degree = 130°.

In the designation of degrees of temperature the symbol + is omitted when the temperature is above 0; but when it is below it, the symbol — must be prefixed.

	Degrees.		Degrees.		Degrees.
Acetification ends	88	Heat, cherry red (Daniell)	1141	Phosphorus boils	560
Acetous fermentation begins	78	" bright red	1860	Pitch melts	91
Air-furnace	3300	" red, visible by day	1077	Platinum melts	3080
Ambergris melts	145	" white	2900	Potassium melts	135
Ammonia boils	140	Highest natural temperature, Egypt	117	Proof Spirit freezes	—7
Ammonia (liquid) freezes	—46	Ice melts	32	Saltpetre melts	600
Antimony melts	951	India-rubber and Gutta-percha vulcanize	293	Sea-water freezes	28
Arsenic melts	365	Iron (cast) melts	2100	Silver, fine, melts	1250
Beeswax melts	151	" (wrought) melts	2980	Snow and Salt, equal parts	0
Bismuth melts	476	" bright red in the dark	752	Spermaceti melts	112
Blood (human), heat of	98	" red hot in twilight	884	Spirits Turpentine freezes	14
" " freezes	25	Lard melts	95	Steel melts	2500
Brandy freezes	—7	Lead melts	594	" polished, blue	580
Brass melts	1900	Mercury boils	662	" " straw color	460
Cadmium melts	600	" volatilizes	680	Strong Wines freeze	20
Charcoal burns	800	" melts	—39	Sulphur melts	226
Coal-tar boils	325	Milk freezes	30	Sulphuric Acid (sp. grav. 1.641) freezes	—45
Cold, greatest artificial	—166	Naphtha boils	186	Sulphuric ether freezes	—46
" " natural	—56	Nitric Acid (sp. grav. 1.424) freezes	—45	" " boils	98
Common fire	790	Nitrous Oxide freezes	—150	Tallow melts	97
Copper melts	2548	Olive-oil freezes	36	Tin melts	421
Glass melts	2377	Petroleum boils	306	Vinegar freezes	28
Gold, fine, melts	2590	Phosphorus melts	108	Vinous fermentation	60 to 77
Gutta-percha softens	145			Water in *vacuo* boils	98
Heat, cherry red	1500			Zinc melts	740

VOLUME OF OXYGEN REQUIRED TO OXIDIZE 100 PARTS OF FOLLOWING FOODS AS CONSUMED IN THE BODY.

Grape Sugar	106	Starch	120	Albumen	150	Fat	293

Hence, assuming capacity for oxidation as a measure, albumen has half value of fat as a food-producing element, and a greater value than either starch or sugar.

PROPORTION OF ALCOHOL IN 100 PARTS OF FOLLOWING LIQUORS.—Brande.

Small Beer	1 and 1.08	Hermitage, red	12.32	Lisbon	18.94
Porter	3.5 and 5.26	Champagne	12.61	Lachryma	19.7
Cider	5.2 and 9.8	Amontillado	12.63	Teneriffe	19.79
Brown Stout	5.5 and 6.8	Frontignac	12.89	Currant Wine	20.55
Ale	6.87 and 10	Barsac	13.86	Madeira	22.27
Rhenish	7.58	Sauterne	14.22	Port	23
Moselle	8.7	Champagne Burgundy	14.57	Sherry, old	23.86
Johannisberger	8.71	White Port	15	Marsala	25.09
Elder Wine	8.79	Bordeaux	15.1	Raisin Wine	25.12
Claret ordinaire	8.99	Malmsey	16.4	Madeira, Sercial	27.4
Tokay	9.33	Sherry	17.17	Cape Madeira	29.51
Rudesheimer	10.72	Malaga	17.2	Gin	51.6
Marcobrunner	11.6	Alba Flora	17.26	Brandy	53.39
Gooseberry Wine	11.84	Hermitage, white	17.43	Rum	53.68
Hockheimer	12.03	Cape Muscat	18.25	Irish Whiskey	53.9
Vin de Grave	12.08	Constantia, red	18.92	Scotch Whiskey	54.32

BOILING POINTS OF VARIOUS FLUIDS.

	Degrees.		Degrees.
Ether	96 to 104	Rectified Petroleum	316
Alcohol, sp. grav. 813	173.5	Oil of Turpentine	304
Nitric Acid, " 1.5	210	Phosphorus	554
" " " 1.42	248	Sulphur	570
Sea Salt	224.3	Linseed-oil	640
Common Salt	226	Sweet-oil	412
Sulphuric Acid, sp. grav. 1.848	600	Sea-water	213.2
" " " 1.3	240	Water, distilled	212

AVERAGE QUANTITY OF TANNIN IN SEVERAL SUBSTANCES.—Morfit.

	Per Cent.		Per Cent.		Per Cent.
Catechu.		*Oak.*		*Sumac.*	
Bombay	55	Young, inner bark	15.2	Sicily and Malaga	16
Bengal	44	" entire bark	6	Virginia	10
Kino	75	" spring-cut b'k	22	Carolina	5
Nutgalls.		" root bark	8.9	*Willow.*	
Aleppo	65	*Chestnut.*		Inner bark	16
Chinese	69	American rose, bark	8	Weeping	16
Oak.		Horse "	2	*Sycamore*, bark	16
Old, inner bark	14.2 / 21	*Sassafras*, root bark	58	*Tan shrub* "	13
		Alder, bark	36	*Cherry-tree*	24

AREAS OF U. S. COAL-FIELDS.

State.	Square Miles.	State.	Square Miles.	State.	Square Miles.
Illinois	44,000	Ohio	11,900	Tennessee	4,300
Virginia	21,000	Indiana	7,700	Alabama	3,400
Pennsylvania*	15,437	Missouri†	6,000	Maryland	550
Kentucky	13,500	Michigan†	5,000	Georgia	150

PROPORTION OF OIL IN VARIOUS AIR-DRY SEEDS.—Berjot.

Beechnut	24	Mustard	30	Almond	40	Orange	40
Hemp	28	Flax	34	Colza	40 / 45	Poppy	40 / 50
Watermelon	36	Pea-nut	38				

* Bituminous and Anthracite.

† Anthracite.

FUEL.

Weights, Evaporative Powers per Weight and Bulk, etc., of different Fuels.—W. R. Johnson and others.

Fuel.	Specific Gravity.	Weight per Cubic Foot.	Steam from Water at 212° by 1 lb. of Fuel.	Clinker from 100 lbs.	Cubic Feet required to Stow a Ton.
Bituminous.		*Lbs.*	*Lbs.*	*Lbs.*	*No.*
Cumberland, *maximum*	1.313	52.92	10.7	2.13	42.3
" *minimum*	1.337	54.29	9.44	4.53	41.2
Duffryn	1.326	53.22	10.14	.....	42.09
Cannel, Wigan	1.23	48.3	7.7	.....	46.37
Blossburg	1.324	53.05	9.72	3.4	42.2
Midlothian, *screened*	1.283	45.72	8.94	3.33	49.
" *average*	1.294	54.04	8.29	8.82	41.4
Newcastle, Hartley	1.257	50.82	8.66	3.14	44.
Pictou	1.318	49.25	8.41	6.13	45.
Pittsburg	1.252	46.81	8.2	.94	47.8
Sydney	1.338	47.44	7.99	2.25	47.2
Carr's Hartley	1.262	47.88	7.84	1.86	46.7
Clover Hill, Va.	1.285	45.49	7.67	3.86	49.2
Cannelton, Ind.	1.273	47.65	7.34	1.64	47.
Scotch, Dalkeith	1.519	51.09	7.08	5.63	43.8
Chili	.....	.....	5.72	.....	.....
Japanese, Takasmia	1.231	48.3	.....	.....	.....
Anthracite.					
Peach Mountain	1.464	53.79	10.11	3.03	41.6
Forest Improvement	1.477	53.66	10.06	.81	41.7
Beaver Meadow, No. 5	1.554	56.19	9.88	.6	39.8
Lackawanna	1.421	48.89	9.79	1.24	45.8
Welsh, Jones & Co.	1.375	58.25	9.46	.....	38.45
Beaver Meadow, No. 3	1.61	54.93	9.21	1.01	40.7
Lehigh	1.59	55.32	8.93	1.08	40.5
Patent, Warlich's	1.15	69.05	10.36	.....	32.44
Coke.					
Natural Virginia	1.323	46.64	8.47	5.31	48.3
Midlothian	.....	32.7	8.63	10.51	68.5
Cumberland	.....	31.57	8.99	3.55	70.9
Charcoal	.....	24.	5.5	.....	104.
Peat	.....	30.	5.	.....	75.
Wood.					
Pine wood, dry	.....	21.01	4.69	.....	106.6

CHARCOAL.

The best quality is made from oak, maple, beech, and chestnut.

Wood will furnish, when properly burnt, about 23 per cent. of coal.

Charcoal absorbs, upon an average of the various kinds, about 5.5 per cent. of water, oak absorbing about 4.28, and pine 8.9.

Its evaporative power, in the furnace of a boiler and under pressure, is $5\frac{1}{2}$ lbs. of fresh water per lb. of coal.

The volume of air chemically required for the combustion of 1 lb. of charcoal is 129.5 cubic feet.

138 bushels charcoal and 432 lbs. of limestone, with 2612 lbs. of ore, will produce 1 ton of pig-iron.

Produce of Charcoal from various Woods.

Apple	23.8	Birch	24.1	Oak	22.85	Red Pine	23.
Ash	26.7	Elm	25.1	" young	33.3	White Pine	23.5
Beech	21.1	Maple	22.9	Poplar	20.5	Willow	18.6

The produce of charcoal by a slow process of charring is very nearly 50 per cent. greater than by a quick process.

WOOD.

Weights and Comparative Values of different Woods.

Woods.	Cord.	Value.	Woods.	Cord.	Value.
	Lbs.			*Lbs.*	
Shell-bark Hickory.......	4469	1.	New Jersey Pine.........	2137	.54
Red-heart Hickory.......	3705	.81	Yellow Pine..............	1904	.43
White Oak...............	3821	.81	White Pine..............	1868	.42
Red Oak.................	3254	.69	Beech.....................	....	.7
Virginia Pine............	2689	....	Spruce....................	....	.52
Southern Pine...........	3375	....	Hemlock..................	....	.44
Hard Maple..............	2878	.6	Cotton-wood.............	....	...

THE END.

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THE END.